RUBBER WORLD

JULY 1960

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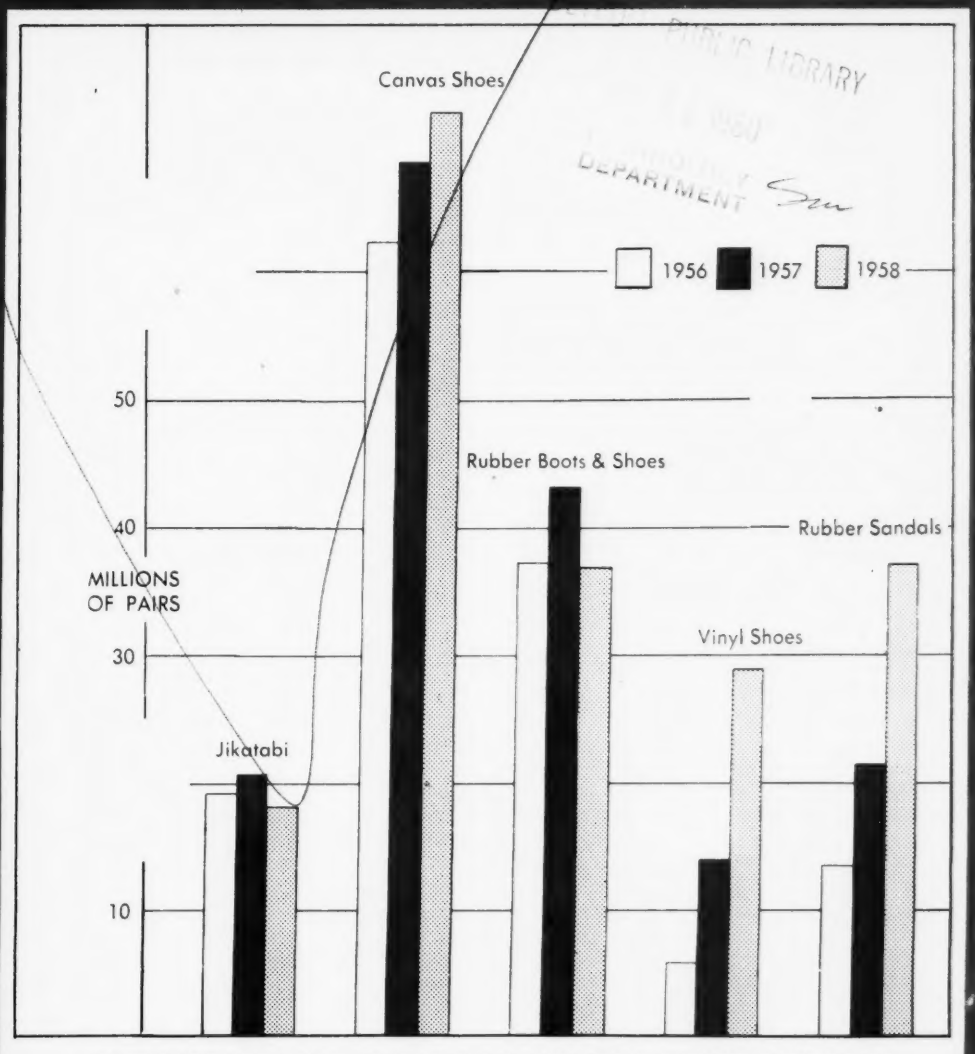

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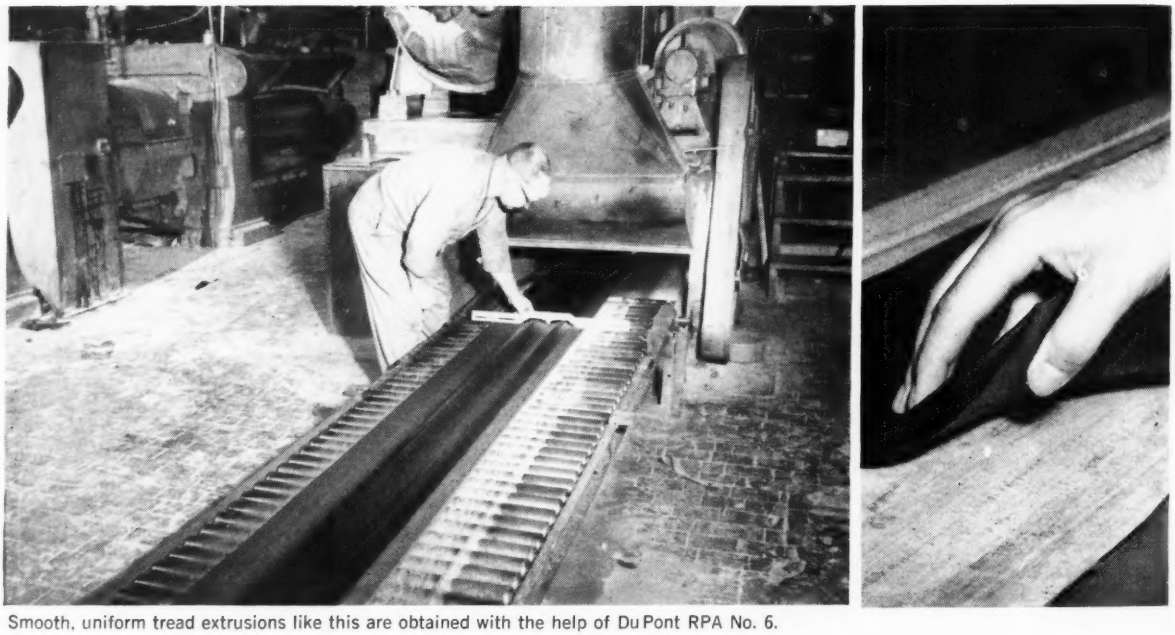
...for smoother, more uniform compounds, with less variation from batch to batch



Smooth, uniform tread extrusions like this are obtained with the help of Du Pont RPA No. 6.

RPA No. 6, a powerful chemical peptizer, helps you reduce batch-to-batch variations. Only a small amount of **RPA No. 6** gives you the advantage of consistently uniform stocks and smoother extrusions . . . nullifying the effects of small variations in the Mooney viscosities of raw polymers. This advantage is especially important to you in hot weather, when cooling water temperatures rise and stocks tend to scorch more often.

RPA No. 6 is an easily dispersed, non-dusting, essentially odorless powder, and can be used for either Banbury or open mill mixing. It peptizes SBR and natural rubber stocks over a wide range of temperatures and has no effect on the cure rate or the ultimate physical properties of the vulcanizates.

For more information about **RPA No. 6,** please contact your nearest Elastomer Chemicals Department District Office.

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This liquid nitrile polymer is an outstanding processing aid for both nitrile rubber and vinyl plastisols. It is non-extractible, non-migrating, and non-volatile.

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See our catalog in Sweet's Product Design File.

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RUBBER WORLD

VOLUME 142 NUMBER 4 JULY, 1960

CONTENTS

65 Government Rubber Industry Statistics; Are They in Need of Improvement?
An editorial by R. G. Seaman

Interpretation of statistics from the various government bureaus has become increasingly difficult, and a joint industry-government committee to review the problem seems desirable.

67 Current Topics in Rubber-To-Metal Bonding
Stewart L. Brams

New ideas on old problems of metal cleaning, testing, one-coat systems, and matching cement to the rubber stock are presented and discussed.

76 New Extrusion Dryer for Low-Ash SBR In Operation at Institute, W. Va., Plant
D. L. Matthews and H. E. Phelps

Goodrich-Gulf has started full-scale production of extruder dried SBR to obtain uniform low moisture.

79 Modulus of Elasticity of Ebonite Materials—I
W. J. Dermody

Tensile measurements on SBR vulcanizates suggest general industry use of excess sulfur.

86 Rubber Division New York Meeting Features

Special lectures and reinforcement symposium highlight plans for September meeting.

Cover photo: Data from The Japan Rubber Manufacturers' Association

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FEATURE DEPARTMENTS

News of the Rubber World	**7**
Book Reviews	**20**
New Publications	**20**
New Equipment	**32**
New Materials	**42**
Meetings and Reports	**86**
Washington Report	**101**
Industry News	**106**
News Briefs	**109**
News About People	**111**
Calendar of Coming Events	**116**
News from Abroad	**117**
Market Reviews	**120**
Synthetic Rubber Prices	**126**
Compounding Ingredients Prices	**128**
Advertisers Index	**139**

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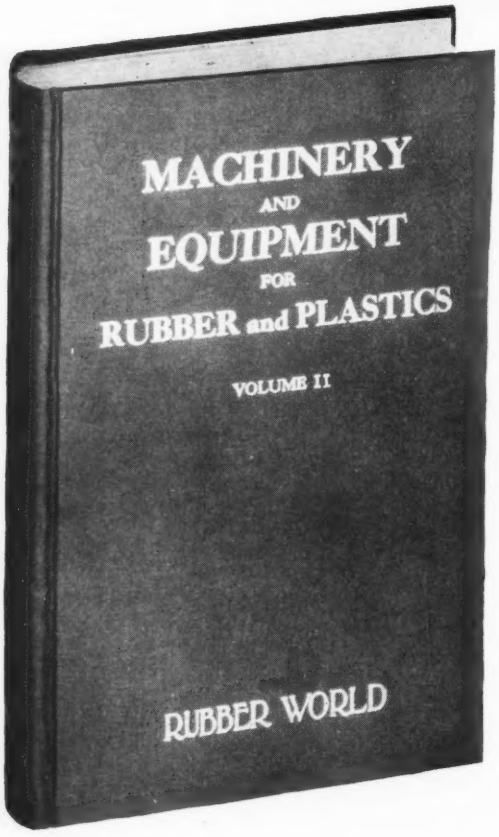
news of the rubber world

Quality control in the rubber industry has tended to become a beneficial method, but also a potential trouble maker in the past few months. Monetary benefits from more closely controlled processes and less rejects are the obvious plus features. Increasing customer pressures that are made in the name of quality control, but verge on the border of internal plant interference, as well as designers who think in metalworking terms have alarmed the members of the RMA Mechanical Goods Subdivision. Recalling the years-long fight against metal dimension tolerances still in progress, a special 15-man committee of QC experts was appointed at a recent meeting to set reasonable rubber industry standards.

Technological improvements in materials for use by the rubber product manufacturer continue to make news every month. United Carbon, after a year of trials, has cast its lot with the non-dispersant-type SBR-carbon black masterb atch. For the consumer - easier processing along with better end-properties. Goodrich-Gulf, again after long trials, is going to give an extruder-dryer a full-scale try-out for SBR drying. Several rumors on methods to dry SBR to obtain low ash with uniform residual moisture have been circulating for some time. Other suggested methods include Banbury drying as well as various other dewatering devices without heat. For the consumer - better electrical properties and better color dispersion.

Competition from imports and methods of increasing exports were subjects of recent Washington confe rences. The rubber industry, in concert with the shoe industry, has become worried about increasing Japanese rubber footwear imports and held discussions with the Senate Small Business Committee, Tariff Commission, State Department, and Census Bureau. Other spokesmen blamed the Commerce Department for stifling exports by excess red tape.

STILL AVAILABLE



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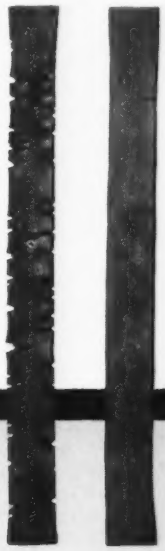
The SBR specimens below were exposed to ozone at 100° F, 20 percent elongation, 52 hr. at 33 pphm ozone, then 187 hr. at 63 pphm ozone.



the kind you choose can be a help or a hindrance . . .

Are you aware of the extent to which some carbon blacks adversely affect the protection afforded rubber products by antiozonants?

Some inactivate much of the antiozonant added for ozone protection. Others are more compatible with the antiozonant.

The two rubber test strips shown at right are clear evidence that carbon black plays an extremely important part in obtaining maximum service life of rubber compounded with antiozonants.

In formulating rubber compounds which must have high resistance to ozone, look to Universal for assistance. Special facilities and technical personnel are available to serve you. Write or telephone our Products Department.

(Left) Carbon black—EPC (easy processing channel), Curing system—2 phr sulfur, 2 phr benzothiazyl disulfide, Hours to first crack—31 to 47.

(Right) Carbon black—HAF (high abrasion furnace), Curing system—2 phr sulfur, 2 phr benzothiazyl disulfide, No cracks in 239 hr.

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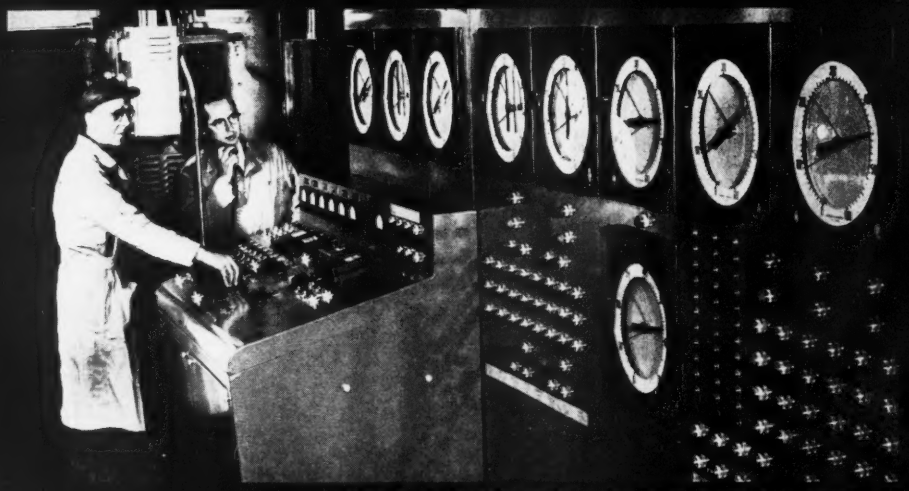

Control Center — Calendar Treating Line Photo courtesy Armstrong Rubber Manufacturing Co.

Whether the simplest kind of equipment installation — or the world's first triple-zone rayon/nylon calendar line as shown here — the moment of startup is the culmination of months of calculation and construction . . . an inexorable test of soundness of engineering, skill of manufacture and field erection.

This unique new process line — highly advanced in operation and control — performed at startup, and after a brief two-week testing and minor adjustment period exploring the multiple operating possibilities, went into full-time production at 60 ypm.

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—as used to make better flower pots at Schacht Rubber Mfg. Co., Inc., Huntington, Indiana.

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Drop one of these flower pots, it bounces back for more. Use it for years, the bright color won't peel or change.

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Why PLIOFLEX 1773? The primary reasons are unusually light color and low cost. Also important are high uniformity and good physical properties which minimize rejects—a vital factor in a volume business. Then, too, its shipment in film-wrapped bales, protected by multiwall bags on nonreturnable pallets, keeps down handling costs and losses.

More information on PLIOFLEX—the many types available and how they might help you—yours by writing Goodyear, Chemical Division, Dept. S-9418, Akron 16, Ohio.

GOODYEAR

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Plioflex—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

CHEMI-VIC puts you on the right track against ozone attack!

The basic feature of new CHEMI-VIC is well described in the photograph above. That's CHEMI-VIC on the left, compared to a similar, currently popular elastomer, after 144 hours in an ozone box (100 pphm) at 100°F.

CHEMI-VIC is brand new—a vinyl reinforced nitrile elastomer. In addition to outstanding resistance to ozone and weather, it offers high physical properties plus exceptional resistance to oil. Moreover, it's easy to compound and process on standard equipment.

New CHEMI-VIC is available in two grades: CHEMI-VIC 400 for general purposes. CHEMI-VIC 800 for extrusion and calendering application. Typical uses: hose, belting, wire and cable jacketing, weather stripping, integral molded shoe soles. More information? Just write Goodyear, Chemical Division, Dept. S-9418, Akron 16, Ohio.

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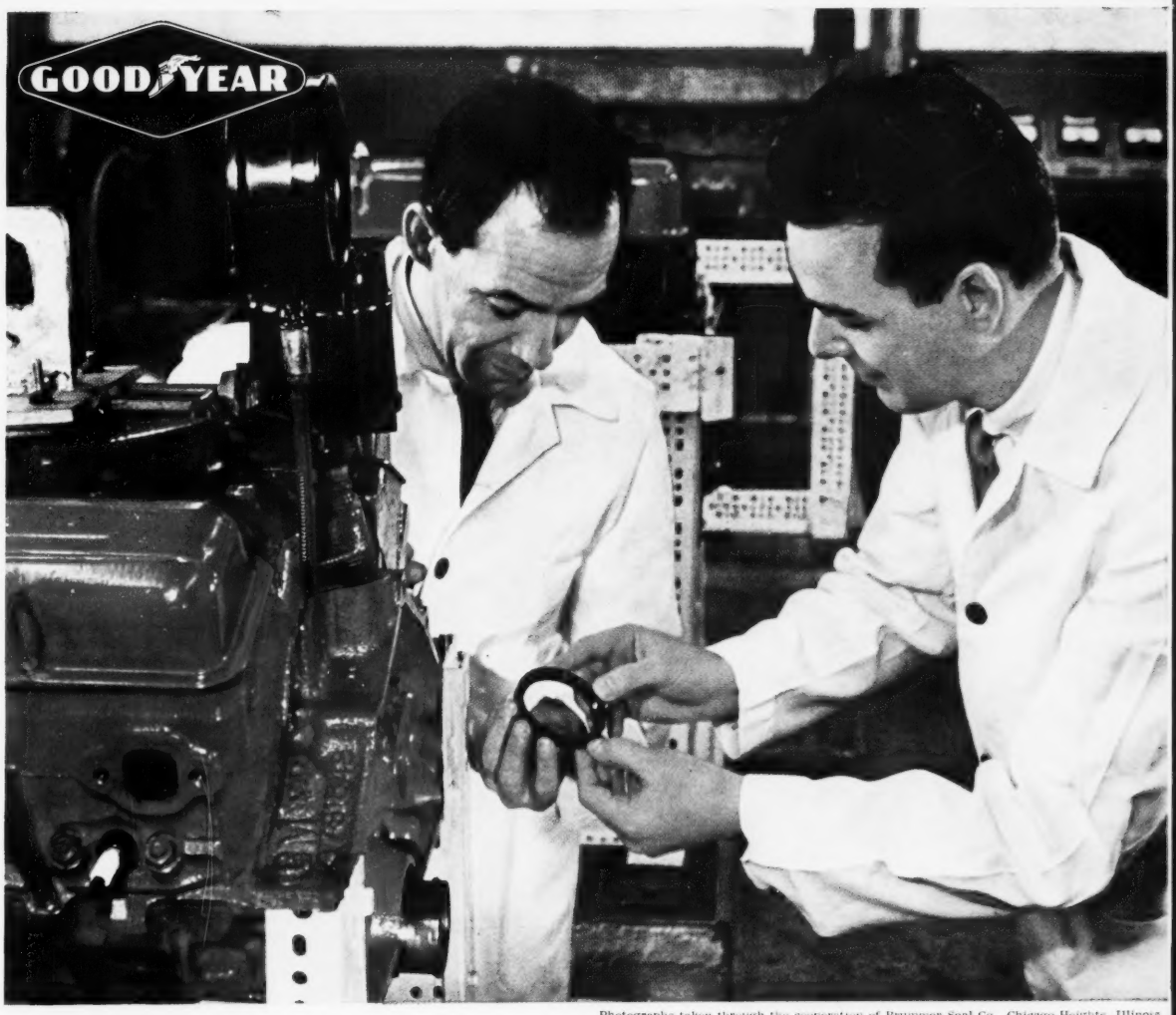
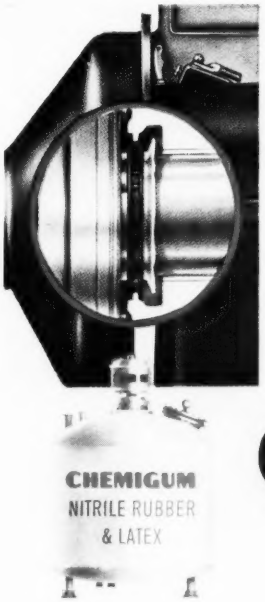
Chemi-Vic—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio



Photographs taken through the cooperation of Brummer Seal Co., Chicago Heights, Illinois

Another "seal of approval"—won with CHEMIGUM!



A long-time problem to automotive engineers and designers was the leaking of oil from rear main bearings. Seals of leather, fiber, metals and other materials just didn't do the right job.

Exhaustive study by a leading manufacturer led to a series of specially designed seals made with CHEMIGUM. CHEMIGUM was chosen because of its outstanding resistance to oil and heat, its toughness and abrasion-resistance and its processability that permitted easy production of smooth, close-tolerance, tight-sealing rings.

Thoroughly proved on the test rack and the test track, these seals of CHEMIGUM have won the approval of a number of manufacturers—are now at work on over a million automobiles. How can CHEMIGUM help your product win similar acceptance? For details write Goodyear, Chemical Division, Dept. S-9418, Akron 16, Ohio.

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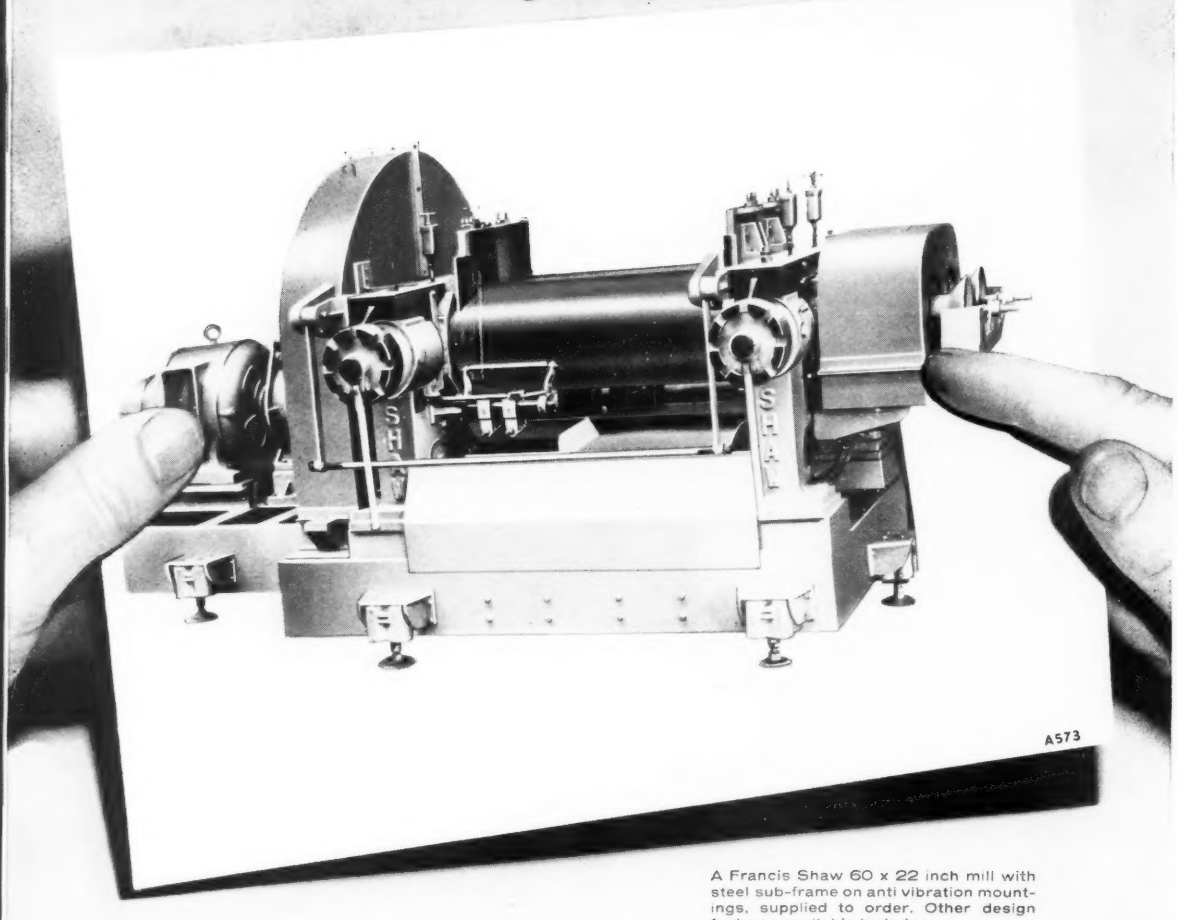

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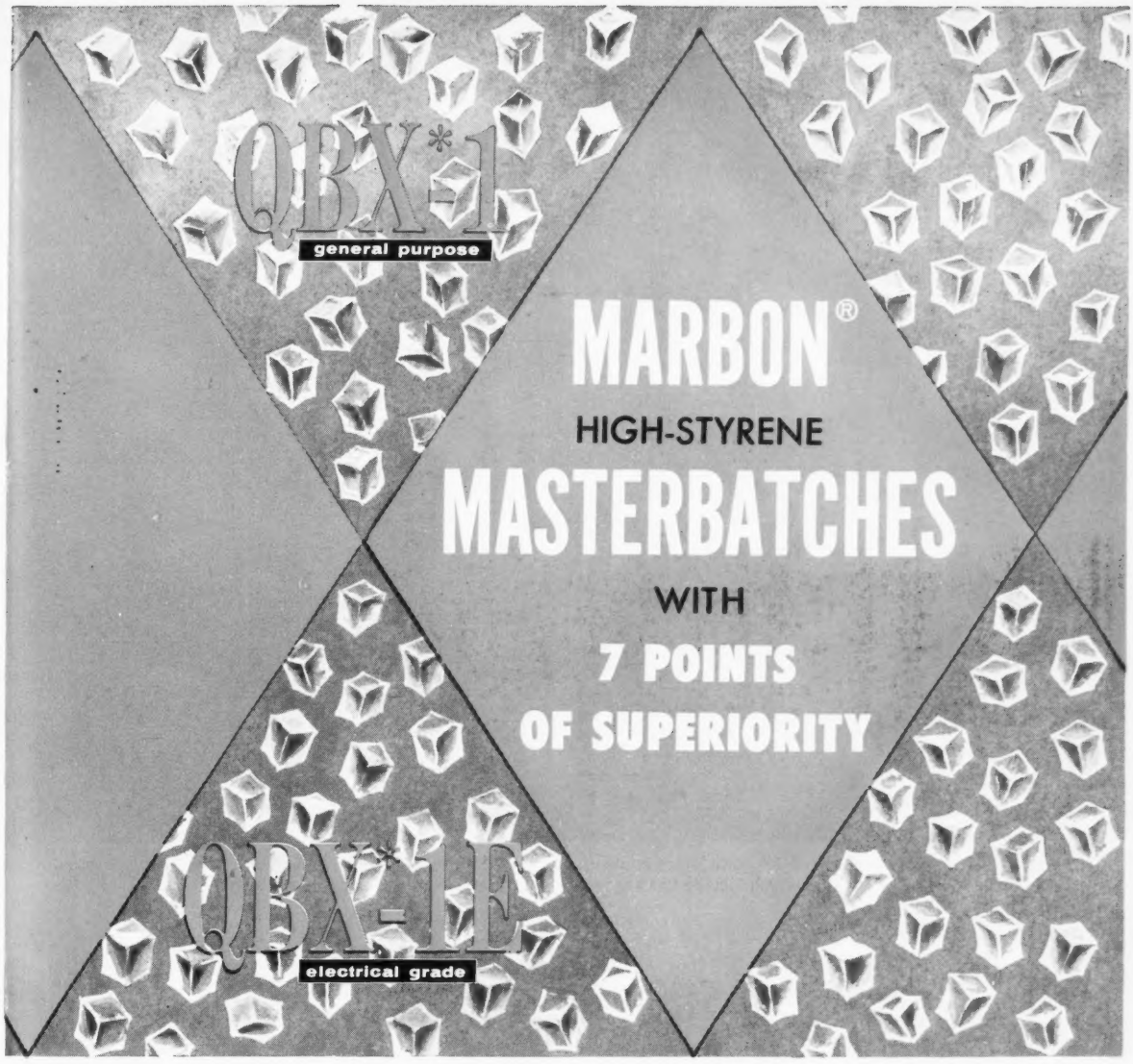
OVERSEAS AGENTS THROUGHOUT THE WORLD

P4351



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New Neville Research And Service Facilities Mean Better Products For You

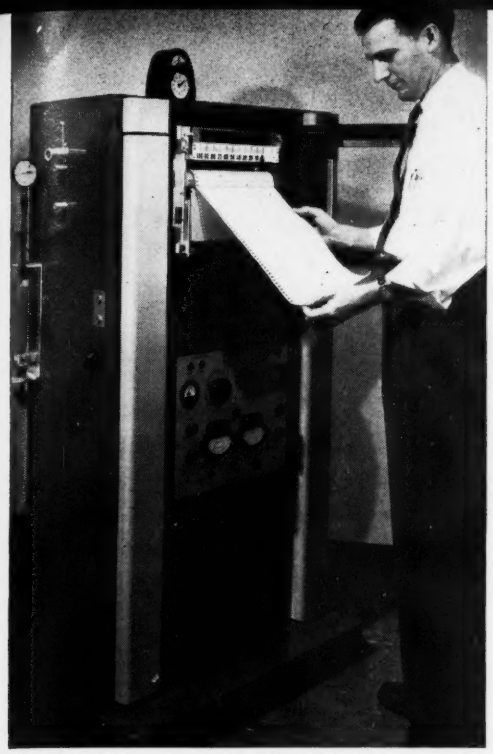
When Neville Chemical Company built its unique office building and research center on Neville Island in Pittsburgh, it did so with its customers in mind. It placed all research, technical service, general administration, sales and even a pilot plant under one roof for quick communications and good coordination. This adds up to better and faster service for you.

Technical facilities were greatly enlarged and divided into four basic sections . . . Technical Service, Research, Process Development and Laboratory Service. In the last three departments, Neville scientists and technicians are constantly striving to find new polymers and chemicals to increase the ability of Neville products to improve those of its customers. In addition, these departments are concerned with the development of new processes, pilot plant studies and analytical research. Through the efforts of this group, Neville developed the country's first commercial process for the production of high purity Indene and Indene derivatives.

The Technical Service Department spends a large measure of its time in technical assistance to our customers. Whether their products are rubber goods, coatings, floor materials, adhesives or any other, Neville studies them for application with our products and for possible improvement. The people in Technical Service pride themselves on often solving problems before customers are aware of their existence.

Neville's thirteen completely new and modern laboratory units function alike for basic research, process development, technical service, laboratory service, and isolating new chemicals or polymers. The laboratories are arranged in a continuous double line with the advanced design pilot plant at the end. Thus, when new polymers have been discovered and studied, they subsequently proceed from one step to the next and continue down the hall to the pilot plant where the commercial feasibility of manufacture is established. In addition to this, the Quality Control Laboratories, which maintain separate quarters in the plant, are constantly at work checking to be certain that every Neville product will conform accurately to specifications.

Much of the benefit of Neville's new facilities could not be readily translated into customer profit were it not for the work of the technical representatives. These highly trained men act as liaison between your plant and the new Neville Island Center. You will find it pays to ask a member of this technical service staff to visit you and bring your formulation problem back to the laboratories for solution.



In the basic research department of Neville's new center, scientist takes a reading from a new Chromatograph to separate and determine chemical components. Not shown is an advanced new infra-red spectrophotometer for even closer identification.

In a room with specially controlled humidity and temperature, an Instron Testing Machine determines the tensile, modulus, elongation and flexual strengths of basic materials from 4 lb. to 10,000 lb. load.

Under constant use at Neville is a Weather-O-Meter in which samples of rubber goods, coatings and many other products undergo aging under accelerated weather conditions.

Key men in translating Neville's new facilities to better service are its corps of technical representatives. One member of this highly-trained field staff is shown here assisting a customer.

Resins — Coumarone-Indene, Heat Reactive, Phenol Modified Coumarone-Indene, Petroleum, Styrenated, Alkylated Phenol • **Oils** — Shingle Stain, Neutral, Plasticizing, Rubber Reclaiming • **Solvents** — 2-50-W Hi-Flash*, Wire Enamel Thinners, Nevsolv* • **High Purity Indene.**

*Trade Name

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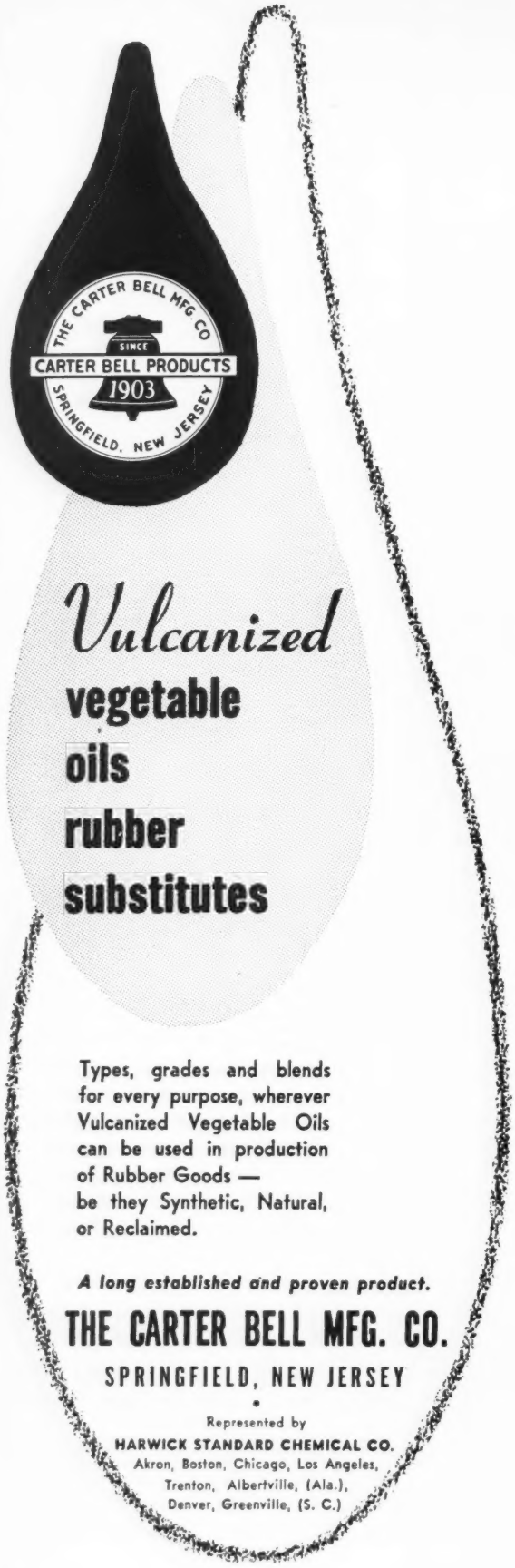
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technical books

BOOK REVIEWS

"ASTM Standards on Rubber Products (With Related Information)." American Society for Testing Materials, Philadelphia, Pa. Hard bound, 9 by 6 inches. 1052 pages. Price to members, $7.80; others, $9.75.

This nineteenth edition of the D-11 compilation is more than 10% larger than the last edition published in May, 1958. The 163 standards include 22 that are completely new and 66 that have been revised or changed in status. Among the new standards are several covering cellular materials of poly(vinyl chloride) or copolymers and urethane foam, two on the effects of radiation, one on abrasion resistance of rubber soles and heels, one on testing automotive air conditioning hose, and several on carbon black.

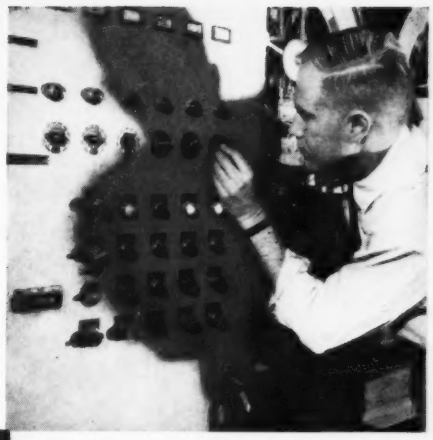
Selected topics include the following: Chemical Tests of Vulcanized Rubber; Physical Tests of Vulcanized Rubber; Electrical Tests; Aging and Weathering Tests of Rubber; Low-Temperature Tests of Rubber; Automotive and Aeronautical Rubber; Packing and Gasket Materials; Hose and Belting; Tape; Electrical Protective Equipment; Insulated Wire and Cable; Hard Rubber; Latex Foam; Sponge and Expanded Cellular Rubber; Synthetic Elastomers; Compounding Materials; and Nomenclature and Definitions.

"Practical Latex Work." H. J. Stern. With foreword by Royce J. Noble. The Blackfriars Press, Ltd., Leicester, England. Reprinted in 1957, Third Edition, 1955. Board cover, 4¾ by 7¼ inches, 96 pages, illustrated. Price, $2.50. This book was previously reviewed in RUBBER WORLD, February, 1956, page 716, but this reprinting is not available from RUBBER WORLD.

NEW PUBLICATIONS

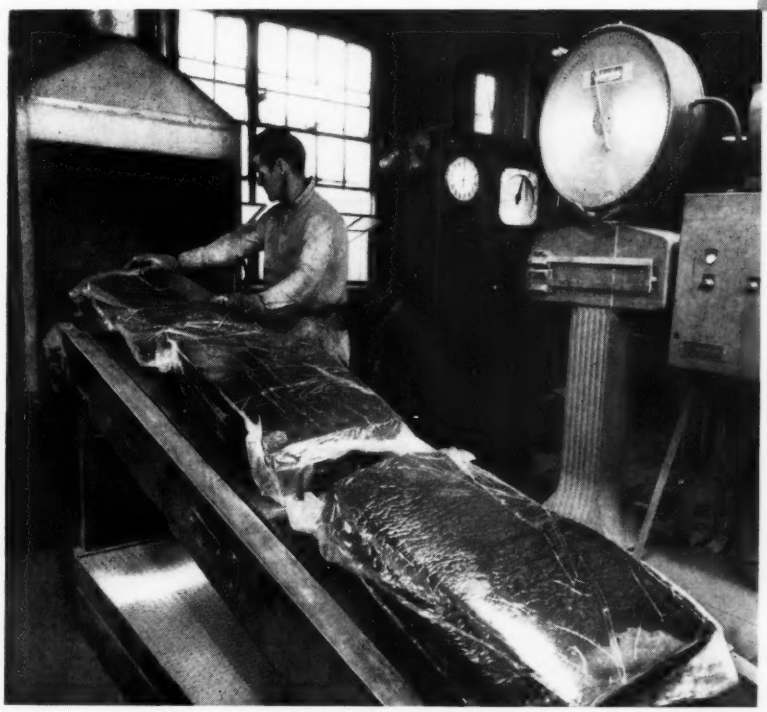
"Specification Compounds for MIL-STD-417 (Ord), MIL-R-3065B (Ord), SB Series." Technical Bulletin No. 5. Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn. 28 pages. This new bulletin has been revised to include military specifications MIL-R-3065B (Ord) Amendment No. 1 and MIL-STD-417 (Ord). The Paracril compounds presented are designed to meet these specifications; however they may also serve as a basis for formulating compounds to solve other problems involving fuel and oil resistance.

Control panel for automatic weighing of masterbatch materials.

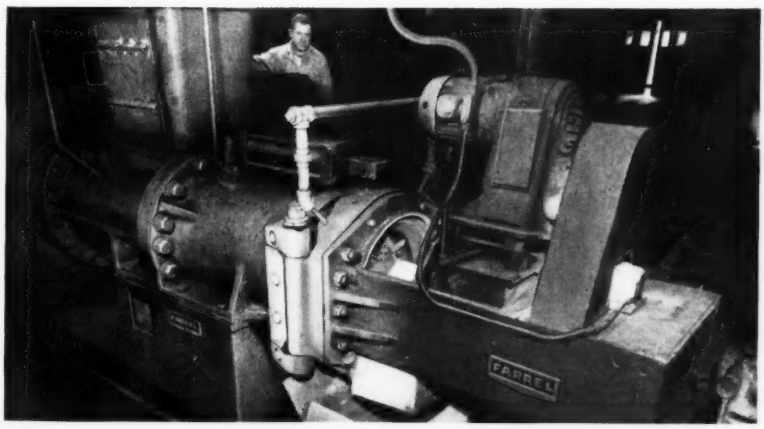


For tire plant...

New Banbury mixing system raises capacity one third . . . cuts defect rate to 0.4%



Operator placing raw rubber on conveyor to Banbury hopper. Later, other ingredients, which have been automatically measured, will be added.



Farrel 15" pelletizer, installed directly under Banbury, produces pellets ⅝" in diameter and discharges them through a slurry onto a vibrating drier. The pellets are then elevated by conveyor in a continuous stream to a penthouse storage assembly, where they are delivered as required to the finish-mix Banbury.

In daily mixing of masterbatches for tire production, Lee Rubber and Tire Corp. employs a system recently developed by Farrel-Birmingham. Designed around a size 11D Banbury® mixer operating at 60 RPM, the setup has increased production capacity one-third.

And, according to Patrick Boyle, assistant director of research and development, "Since we began using this new Banbury mixing system, we've kept charts based on a data list from 4500 batches. Out of that number only 18 batches have been 'out of spec.' That amounts to only fourtenths of one per cent, which is a considerable reduction from our previous defect rate."

Operation of the system is almost completely automated with material handling, weighing, charging and mixing being controlled through preset variable resistors. Four different blacks are handled in any combination, and six different oils. The Banbury discharges directly into a 15" pelletizer, which transforms the batch into easily weighed pellets. These are conveyed as required to the finish-mix Banbury.

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"The Journal of 'Teflon.'" Polychemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. This technical bulletin-type journal briefs various papers and gives references on the company's "Teflon" TFE and "Teflon" FEP fluorocarbon resins. A monthly, the journal covers applications and properties of these commercially available materials.

"Hycar Latex Newsletter. No. 20." B. F. Goodrich Chemical Co., Cleveland, O. 8 pages. This May, 1960, issue of the Newsletter contains four articles: (1) "Sheet Made from Leather Scrap with Hycar Latex"; (2) "Hycar-Glitter Decorative Paper Coating Compound"; (3) "Chemically Blown Hycar Latex Foam Coatings"; and (4) "The Chemical Stability of Hycar Latices." Tables and graphs are included.

"Sterling Multi-Shielded AC Motors." Catalog No. 200. Sterling Electric Motors, Inc., Los Angeles, Calif. 56 pages. This comprehensive catalog includes complete pricing and dimensional data on AC Multi-Shielded motors, ranging from ¼ to 200 horsepower. Information is included for various modifications, such as specialized mountings and enclosures, as well as the new Sterlicone multi-shielded drip-proof motors.

"Bostik Adhesives in Product Design." B. B. Chemical Co., Cambridge, Mass. 4 pages. This bulletin was prepared to provide product designers with up-to-date information on the company's line of adhesives. Principal uses and characteristics of representative formulations in the Bostik line are grouped in an easy-to-read table. A separate section of the bulletin describes in general terms solvent base, water base, and hot melt adhesives made by the company.

"Nalco Sodium Aluminates." Nalco Chemical Co., Chicago, Ill. 12 pages. The industrial uses, physical and chemical characteristics of Nalco sodium aluminate are described in this two-color brochure. The bulletin outlines, with references, how the chemical can be used in such industries as chemical processing, rubber, textile, paint and pigment, and others. Reference is made to the use of sodium aluminate as a curing agent for carboxylic latices.

"General Electric Liquid RTV Silicone Rubber." CDS-226. Silicone products department, General Electric Co., Waterford, N. Y. 12 pages. This booklet highlights the outstanding properties of room-temperature vulcanizing liquid silicone rubber and illustrates its uses in electronic and electrical assemblies, as a sealing, coating impregnating, and bonding compound in a variety of applications, and its performance as a flexible mold material. A special section is devoted to an up-to-date review of RTV applications as a sealant in aircraft and missiles.

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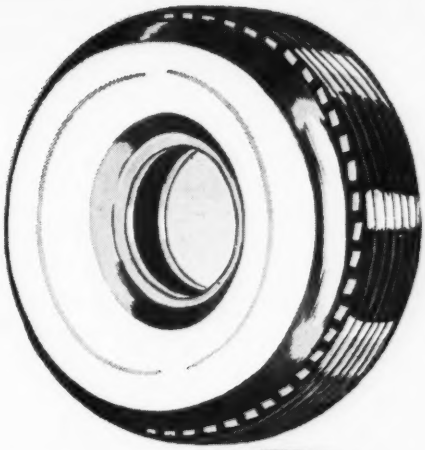

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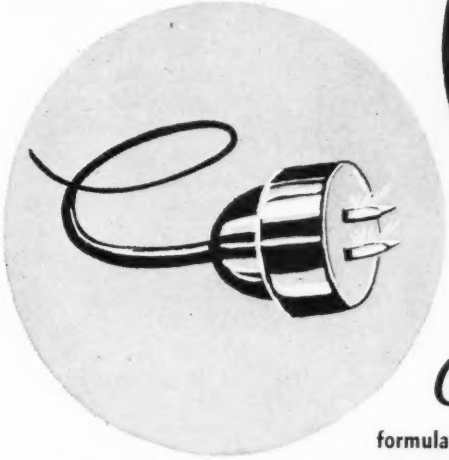

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technical books

Publications of the chemical division, The Goodyear Tire & Rubber Co., Akron, O.:

"Goodyear Latex-Types and Properties." Tech-Book Facts L-4. 4 pages. This data sheet gives in tabular form the typical properties of the company's Chemigum, Pliovic, and Pliolite latices. The latices, available in these three basic types, are classed by a characteristic chemical unit, nitrile, vinyl and styrene. Each monomer's influence on the properties of the copolymers is briefly described.

"Pliolite Rubber Latex: Types and Properties." Tech-Book Facts PLL-10. 2 pages. The typical properties of Pliolite butadiene-styrene hot and cold latices are covered. The types include Pliolite Latex 2000, 2001, 2105, 5350, and 5353.

"Pliolite Resin Latex: Types and Properties." Tech-Book Facts PLL-11. 2 pages. This data sheet deals with the Pliolite butadiene-styrene emulsion polymers having more than 50 parts styrene. Typical properties appear for Pliolite types 140, 160, 170, and 151.

"PA 80." Technical service division, Natural Rubber Bureau, Washington, D. C. 8 pages. This bulletin describes PA 80 Rubber, a unique new material developed by the Rubber Research Institute of Malaya, the use of which is said to produce superior processing properties in all grades of natural rubber and in some SBR stocks. In PA 80 the ratio of cross-linked to ordinary rubber is 80/20 as against 20/80 in the familiar SP regular grades. The bulletin gives use, compounding data, and vulcanizate properties.

"Re-thinking Thermal Insulation." National Insulation Manufacturers Association, New York 17, N. Y. 16 pages. This new guide to the best use of thermal insulation materials emphasizes the economic thickness approach to specification, enabling engineers to determine the point at which insulation gives the greatest financial return for its cost. Detailed descriptions and characteristics of types of insulation are given. The booklet also contains an index to ASTM and government specifications.

Publications of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.: **"News about Du Pont Elastomers & Chemicals."** March, April, May, 1960. 4 pages. **"Neoprene Pressure-Sensitive Mastic."** BL-367. By L. S. Bake. 2 pages. **"Fungus Resistance of Neoprene."** BL-368. By G. B. Ritzinger. 4 pages. **"NBC."** Report No. 60-1 By R. W. Bell and G. B. Ritzinger. 8 pages.

" 'Hypalon' Report. A Comparison of 'Hypalon' 20, 30 & 40." No. 1, May, 1960. By J. R. A. Burton. 4 pages. This is the first of the new series of reports devoted exclusively to information on "Hypalon."

(Continued on page 48)

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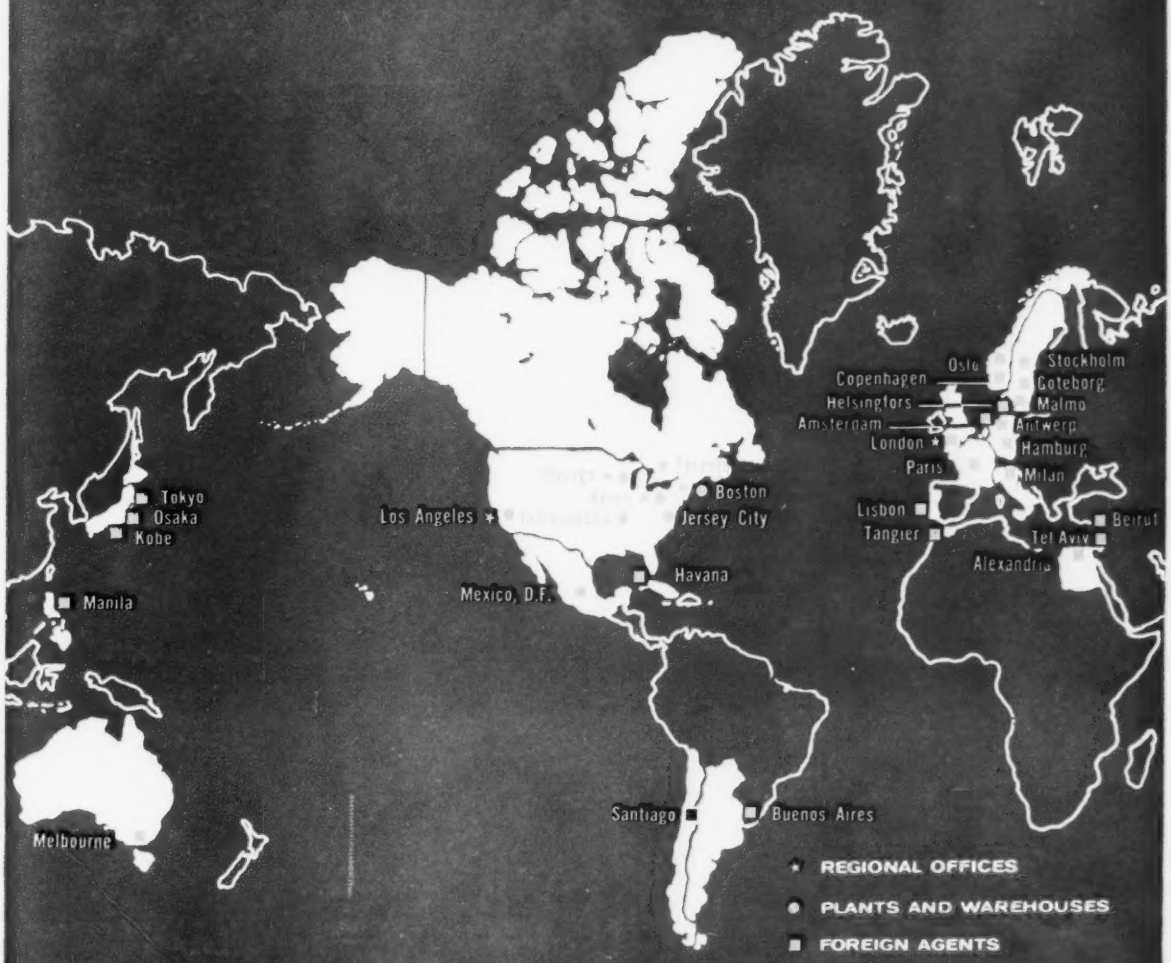

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NS SPECIAL WIRE (575,000 psi) WRAPS

In the development of solid-fuel rocket cases, a leading manufacturer fabricated and experimented with welded steel and glass fibers, as well as many steel wire specimens, to find a fuel case material with the most favorable strength-to-weight ratio for fuel case applications.

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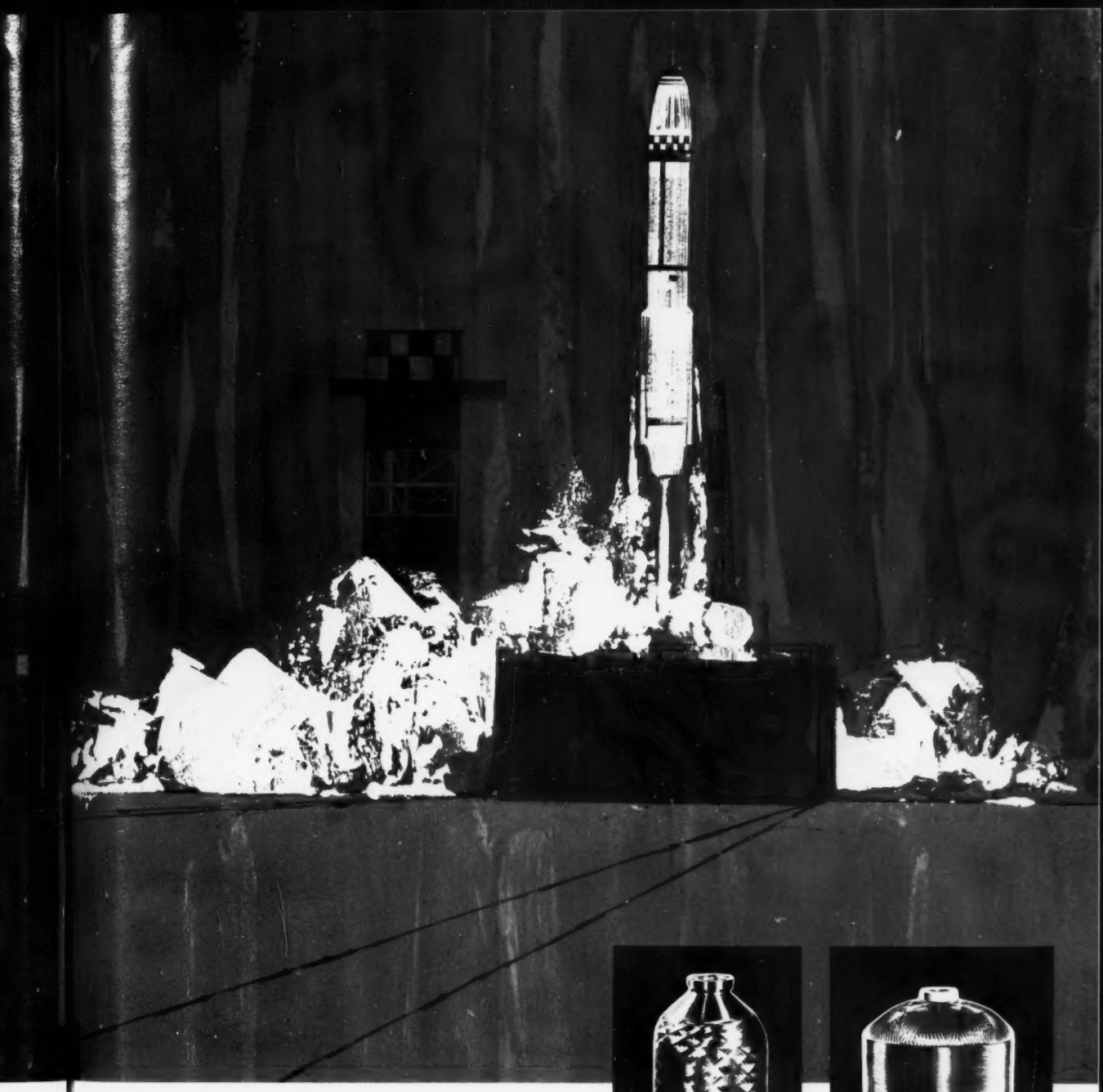

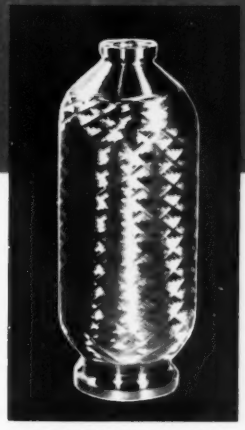

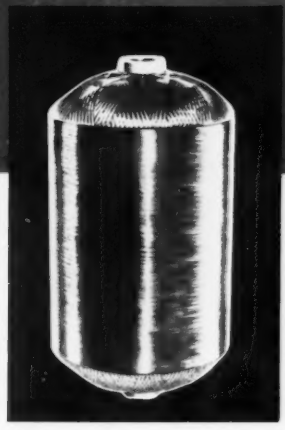

WIRE-WRAPPED ROCKET CASES are wound over collapsible mandrels using a number of strands of very high strength, small diameter wire formed into tapes.

ROCKET FUEL CASES

The end result of NS—customer cooperation was the ability to produce wire-wrapped rocket cases with very high hoop stress and lower cost than those being produced by other methods. And the fuel case manufacturer is able to provide maximum case-to-case reliability.

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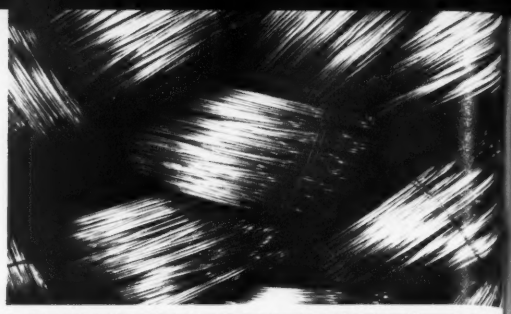

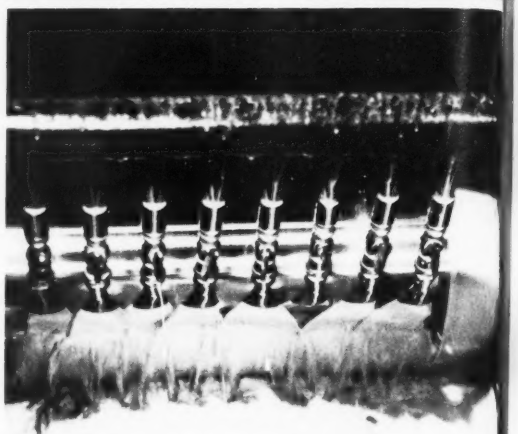

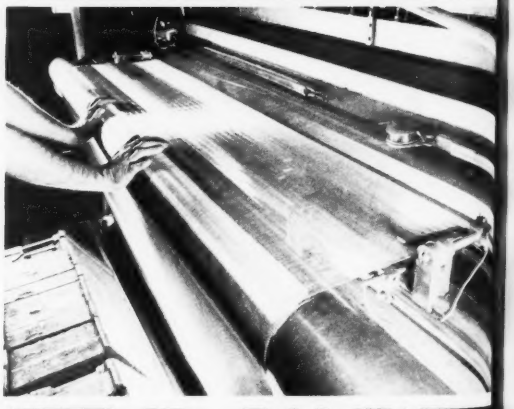

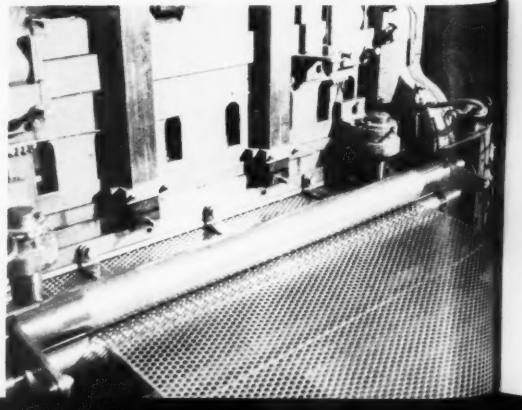

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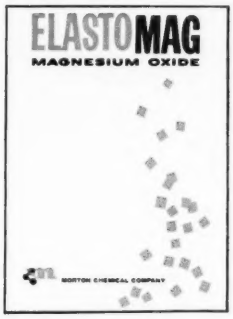

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The most recent inventions and experiences of Godfrey L. Cabot Inc., who supplied the know-how, and the Royal Sulphuric Acid Works Ketjen Ltd. have resulted in many new features in carbon black plant construction. Revolutionary for this industry is the abundant use of stainless steel whereby an end-product is obtained with extremely low grit content. The two units are equipped with ready to start spare engines and the power and steam required are generated in the plant, assuring continuous and uninterrupted operation so essential for uniform quality.

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KETJENBLACK HAF
KETJENBLACK FEF
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an oil black which replaces channel black and

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a modified ISAF with attractive novel characteristics, will also be available.

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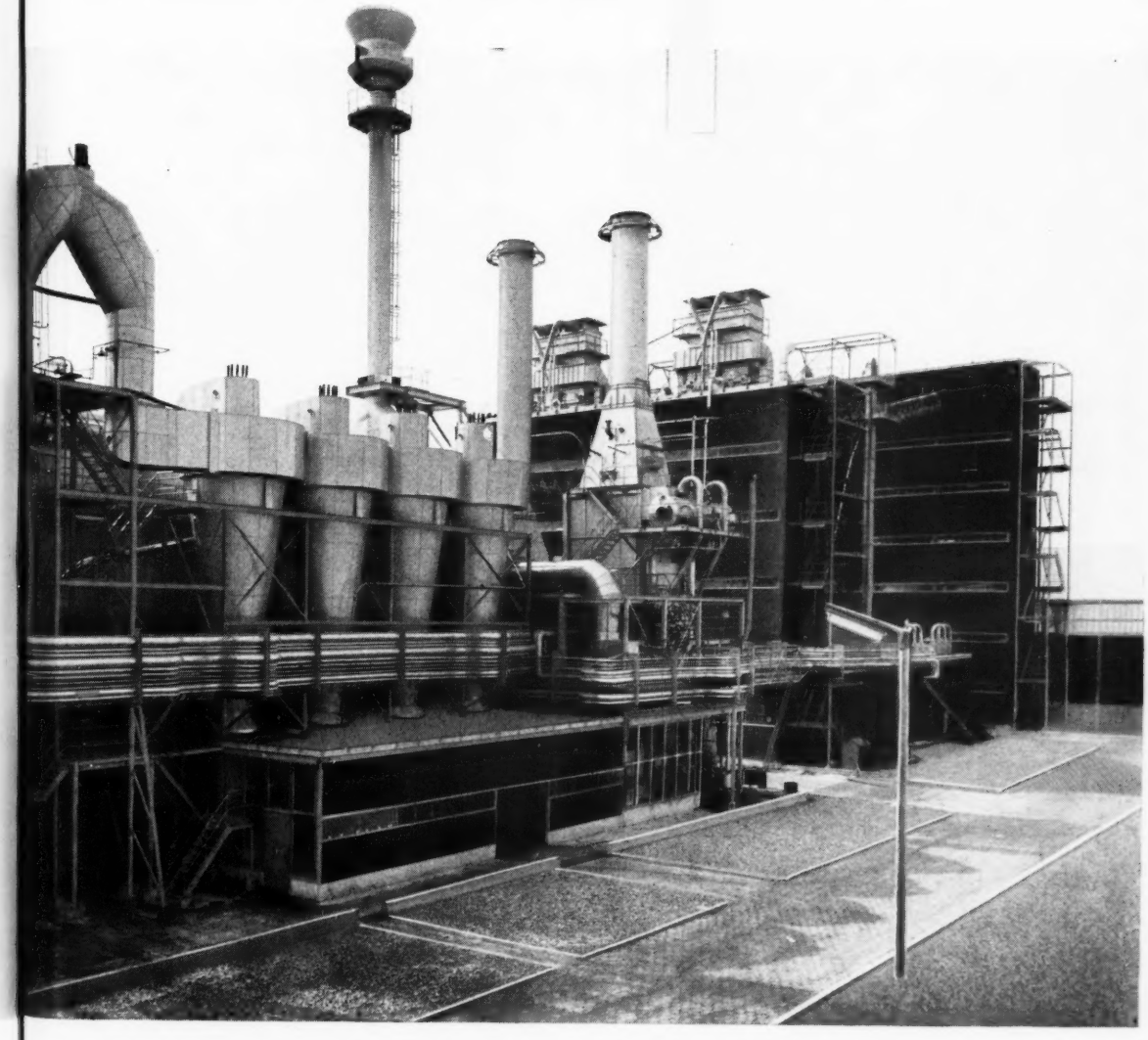

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- Reduces heat loss in molds
- Reduces cycle time
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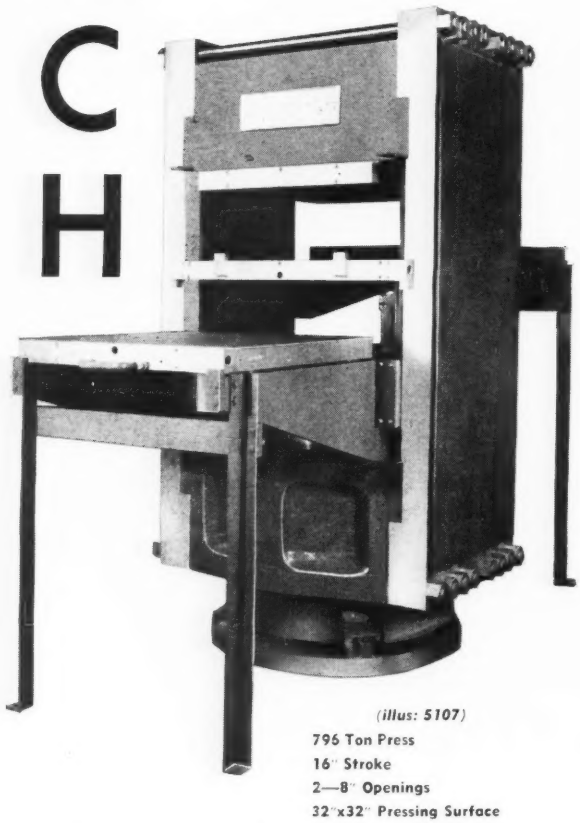

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2—8" Openings
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new equipment

Drum handler *(insert)* is easily adapted to new fork-truck model

Fork-Truck Drum Handler

Specialty Machinery Corp., Newark, N. J., has added a fork-truck adapter model to its line of all-purpose drum handlers. The drum handler requires no attachment to the fork truck.

Any standard fork truck with a clearance of 24 inches between the forks can pick up a model F-69 drum handler and set it down quickly and easily, reports the manufacturer.

The standard unit comes equipped with a hand chain operated tipper and grabs for steel drums. A variety of accessories is available to extend the utility of the unit. These include fiber drum grabs, carboy grabs, and a bag adapter.

New Fiberboard Tote Boxes

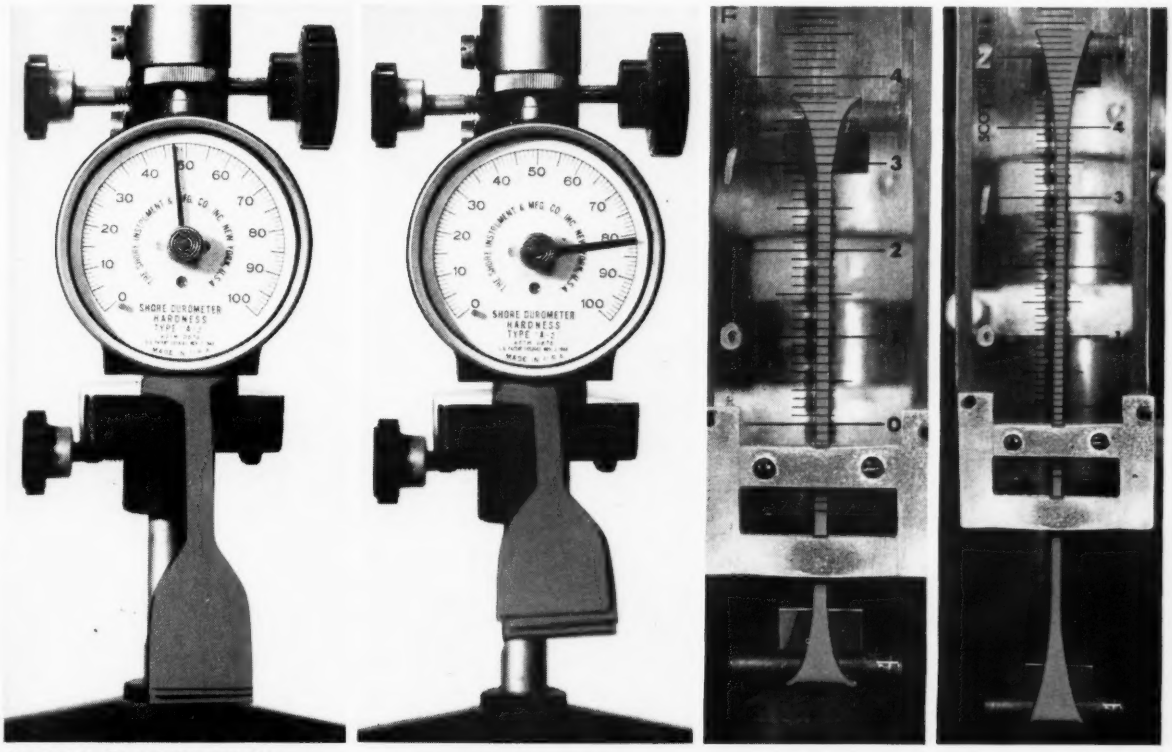
New specially hardened fiberboard materials-handling (tote) boxes weighing less than four pounds each are now available from Beacon Boxes, Inc., Massillon, O. Each box is capable of supporting 150 times its own weight, without distortion. A typical-size box has a 3.2-cubic-foot capacity.

Besides being extremely rigid and lightweight, Beacon boxes are fireproof and will not tarnish copper, brass, etc., reports the company. Custom and standard sizes are available in three styles, with capacities of 1/100 cubic foot to 5 cubic feet. The three styles range in size from 2½ by 4 by 1½ inches to 24 by 30 by 15 inches.

(Continued on page 36)

SILICONE NEWS from Dow Corning

Pick A Property; Compound It!



SILASTIC SILICONE RUBBER — Now Offered in Most Versatile Masterbatch

Newly introduced 433 Base, a masterbatch of Silastic®, the Dow Corning silicone rubber, allows you greater formulating freedom. With this one new base material you can compound for the exact properties you want in silicone rubber. Does one customer's product call for a 50 durometer rubber? . . . another an 80 durometer? . . . does one need high elongation? . . . another low elongation? You can make them all from the same masterbatch. In short, you can now match the properties that were formerly available only in pre-compounded commercial stocks.

Easy Processing. Silastic 433 Base is exceptionally easy to process, and has excellent green strength. Heat stability to over 500 F is built-in. There's no need for special additives. Silastic 433 Base has a shelf life of 6 months, and is readily available now. At right are some sample recipes and their typical properties. If you want to know more about recipes and procedures, just ask . . . Dow Corning has a library of information, plus extensive developmental facilities and technical service.

All this, and a simpler inventory, too!

Sample Recipes and Typical Properties

. . . For 50 Durometer Silastic	
Silastic 433 Base	100 parts
Cab-O-Sil MS-7	7 parts
Celite Super Floss	3 parts
Luperco CSF or Cadox TS-40	1.8 parts
* Durometer (Shore A)	50
Tensile strength, psi	800
Elongation, %	240
Tear Strength, lbs/in	60
. . . For 80 Durometer Silastic	
Silastic 433 Base	100 parts
Cab-O-Sil MS-7	28 parts
Luperco CSF or Cadox TS-40	1.8 parts
* Durometer (Shore A)	80
Tensile strength, psi	700
Elongation, %	150
Tear strength, lbs/in	85

* Vulcanized 5 min. at 240 F; cured 24 hours at 480 F.

Write Dept. 7907 for full details on new Silastic bases.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

No loose black
No bulk oil
No unpigmented rubber

Gentro-Jet®

assures savings in shipping, storage and handling

You can save many ways with Gentro-Jet, General Tire's steam-whipped SBR-carbon black masterbatch. Shipped on neat, easy-to-handle skids, Gentro-Jet takes less floor space and eliminates the problems of loose black, irregular bales of rubber and drums of oil stacked for use.

Gentro-Jet is ready for the banbury—ready to help *you* increase profits, product quality and plant efficiency. Write for details and valuable literature today.

Gentro-Jet Black Masters offer:
Increased tire tread life • Faster proccessing
Cleaner in-plant operation • Selection of types to meet your needs

Creating Progress Through Chemistry

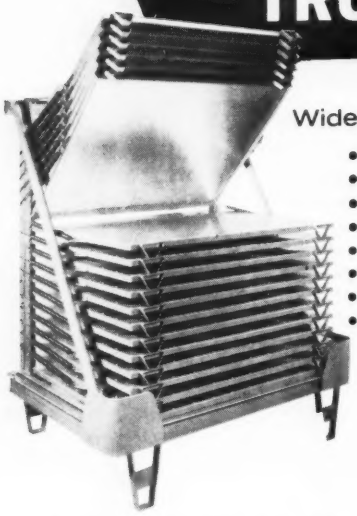
Chemical Division GENERAL
THE GENERAL TIRE & RUBBER CO.

THE GENERAL TIRE & RUBBER COMPANY
CHEMICAL DIVISION • AKRON, OHIO

Chemicals for the rubber, paint, paper, textile, plastics and other industries: **GENTRO SBR** *rubber* **GENTRO-JET** *black masterbatch* • **GEN-FLO** *styrene-butadiene latices* • **GEN-TAC** *vinyl pyridine latex* • **GENTHANE** *polyurethane elastomer* • **ACRI-FLO** *styrene-acrylic latices* • **VYGEN PVC** *resins* • **KURE-BLEND** TMTD *masterbatch* • **KO-BLEND** *insoluble sulfur masterbatch*

Extra Protection . . . Fast Cooling and Drying
Conserve Floor Space With . . .

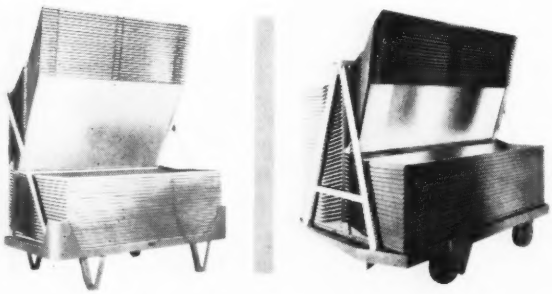
SPADONE
SPRING LEAF
TRUCKS



Widely used for . . .

- TIRE TREADS
- PLASTICS
- SOLINGS
- TILINGS
- ADHESIVES
- OVENS
- MILL BATCHES
- CALENDER STOCK

Spadone Trucks are built to withstand rough handling and assure years of maintenance-free service. Floating spring action raises and lowers trays at a touch. Heavy duty casters roll smoothly and easily and are positioned to provide maximum maneuverability.



All Spadone Trucks are custom built to order and designed to meet your individual requirements. Whatever the problem we will be happy to assist you, and all inquiries will have our prompt and careful attention.

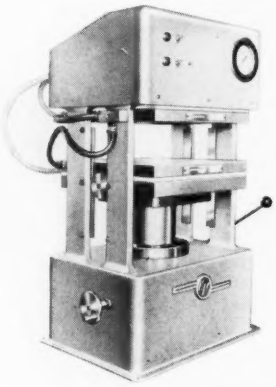
Write for detailed information.

SPADONE MACHINE CO. INC.

SOUTH NORWALK, CONNECTICUT • Phone: VOlunteer 6-3394
Illinois Office: P.O. Box 328, LaGrange • Phone: FLeetwood 4-4811

(Continued from page 32)

KM 75-Ton Hydraulic Press



Kingsbacher Murphy 75-ton press

A new 75-ton hydraulic press that can be used for molding, laminating, or testing of plastics and rubber materials is being manufactured by Kingsbacher Murphy Co., Los Angeles, Calif.

Platens have a surface area 19 by 19 inches, are electrically heated, and are furnished for steam heating or water cooling. Each platen is constructed of fabricated steel with a cast-aluminum interior to provide proper heat transfer characteristics, good overall strength, and the prevention of platen warping or pitting.

Each platen, moreover, has an adjustable thermoswitch connected to its highly sensitive mercury relay. The combination of thermoswitch and relay are said to control accurately the platen temperature to 600° F.

A newly designed four-column welded steel frame provides precision self-alinement of the platens and gives the press maximum strength and durability and a minimum amount of weight and floor space. The daylight opening between platens varies from zero to 11 inches.

A variety of hydraulic units is offered for closing platens and raising pressure. Both manual and motorized powered pumps are available. Special pressure test gages, heat control units, and other accessories, as well as a descriptive brochure, are available from the company.

Cesco Steel Drum Dumper

The Cesco steel drum dumper for automated handling of steel drums has been announced by Conveyors & Dumpers, Inc., division of Mercury Industries, Hillsdale, N. J. This dumper line is designed to operate at lifting heights of from 12 inches to 50 feet, emptying the contents into mixers, tanks, tumblers, chutes and conveyors. The line features speedy dumping, easy loading, keeping manual labor to a minimum, reports the company.

Rated capacities are from 100 to 5,000 pounds, depending upon the individual unit. The Cesco dumper handles such materials as powders, granulars, stampings, castings, scrap, and viscous liquids.

A comprehensive six-page folder for plant engineers is available upon request.

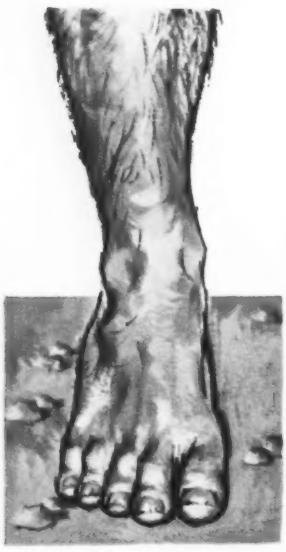
Some useful information for the men who shape the things we stand on...

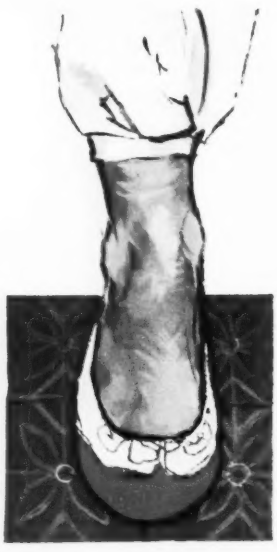
18,000 B.C.—Mousterian man was self-shod, and gingerly trod a clay-and-gravel floor. His was a lifetime sort of footwear and the wearers had to be calloused customers.

800 B.C.—The soft leather shoe of ancient Persia gave excellent footing on floors of polished tile. The shoe looked like a small girl's pump, but the wearers were really tough warriors.

300 B.C.—Alexander and Archimedes wore simple sandals like these in the marbled halls of ancient Greece. It's a far cry from the spring and wear of a modern S-Polymer shoe sole.

800 A.D.—Cold steel on colder flagstone marked the medieval knight. No pussyfoot was he. With a built-in gong on either foot, no wonder his feats ring through the Ages.





S-Polymers will improve

Modern man walks on and in products made from S-Polymers from Shell Chemical. They simplify processing; impart toughness, flexibility and long life.

S-1509

A low-viscosity cold rubber, S-1509 provides light color, outstanding physical properties and superior mold flow.

SP-103

A resin-rubber masterbatch, SP-103 offers similar advantages because the rubber hydrocarbon in SP-103 *is* S-1509. SP-103 is made from equal parts of S-1509 and high styrene resin for added abrasion resistance, gloss, stiffness and durability.

Light Color . . . Nonstaining and nondiscoloring S-1509 and SP-103 are excellent for white stocks because of their own inherent light color and also because they need no discoloring peptizing agents.

Low Viscosity . . . S-1509—by itself or in SP-103—has a viscosity range of 30-38; it needs no breakdown and comes to you ready for immediate processing even in sponge applications.

Outstanding Physical Properties . . . Properties of S-1509 stocks closely compare with those of plasticized high Mooney counterparts.

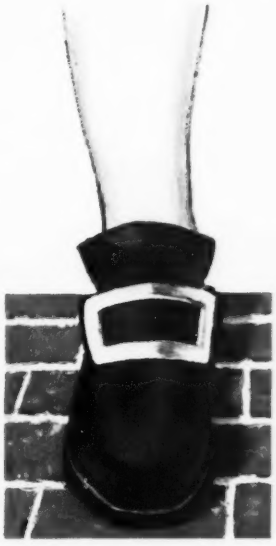
Superior Mold Flow . . . Stocks made with S-1509 and SP-103 provide sharp design

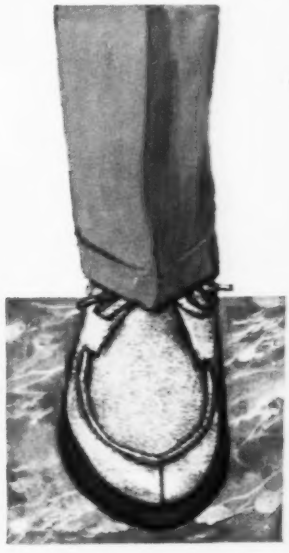
1300 A.D.—When the Mayan dandy wanted shoes he simply milked a rubber tree and used his foot for the mold. Use of *shoe soup* was free to all. The style was crude; the fit perfect.

1776 A.D.—Freedom of the feet came fast on the heels of tyranny with light, comfortable walking shoes and smooth, quick-drying brick walks. It was an era of advanced "understanding."

1890 A.D.—Patent leather shoes with spats on slick parquet floors marked a night out during the Gaslight Age. Elegance outweighed wear and corns were epidemic.

1960 A.D.—Ultimate in "footwork" is the comfortable shoe sole made with an S-Polymer. S-Polymers also give us handsome, long-wearing rubber tile, luxurious sponge rug underlay, and dozens of other products.





ve today's "footwork"

transfer from the most intricate mold to the finished product.

Reduced Mixing Time . . . Your in-plant mixing time is significantly reduced with SP-103 because the resin is added at the latex stage and is thoroughly dispersed.

Reduced Scorch . . . When you use SP-103 instead of mixing in clear resins yourself, there is less tendency to scorch because shorter mixing time is required, making possible lower mixing temperatures.

Convenience and Economy . . . SP-103 comes to you in free-flowing crumb form, minimizing loss of material and dust problems encountered with clear resins.

SHELL CHEMICAL COMPANY

SYNTHETIC RUBBER DIVISION

P. O. Box 216, Torrance, California

Shoe-sole manufacturers are finding two recent technical bulletins helpful. Just fill out and mail the detachable postcard. Do it now—no stamp is necessary.

SHELL

SHELL CHEMICAL COMPANY:

I would like to receive the following bulletins:

MICROCELLULAR SPONGE SOLING (SC:59-27) contains formulations and data on the effects of precure and postcure on shrinkage, specific gravity and hardness. ☐

S-POLYMERS IN SHOE SOLES (SC:60-24) gives a variety of formulations for shoe soles from oak to athletic soles. ☐

Name_____

Company_____ Title_____

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...and Shell Chemical also gives you:

- **Fast, efficient delivery.**
- **Improved packaging such as the Flotainer® which controls cold flow.**
- **Technical service wherever you need practical solutions to difficult problems.**

In addition, Shell Chemical offers you the widest range of synthetic rubber polymers available from a single source—more than thirty-five kinds—including non-extended hot and cold rubber; black, oil-black and resin-rubber masterbatches; hot and cold latices.

Write or phone for more information on Shell Chemical synthetic rubbers and latices.

SHELL MANUFACTURES NO FINISHED RUBBER PRODUCTS—

ONLY HIGH QUALITY SYNTHETIC RUBBER FOR INDUSTRY

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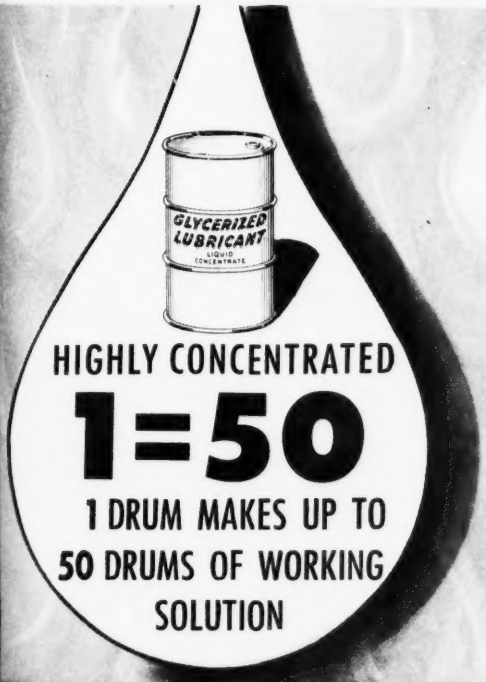
(LIQUID CONCENTRATE)
LUBRICANT

PREVENTS STICKING

A microscopic film of
GLYCERIZED LUBRICANT
(LIQUID CONCENTRATE)
You won't be able to see it on the rubber but you will know of its presence because of the non-adhesive properties it imparts. Does not interfere with tack or knit of stock.
ASK FOR SAMPLE



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BROTHERS
RUBBER MATERIALS DIVISION
West 48th Place and Whipple Street
CHICAGO 32, U. S. A.

Also Mfgrs. of **RUBBEROL** **SYNTHOL** **MICROFLAKE**

RECLAIMATOR® RUBBER...

...stays cool, too!

There is a "raft" of reasons why RECLAIMATOR rubber stays cool in *your* compound.

It is more completely devulcanized and breaks down more quickly and easily than conventional reclaimed rubber. Consequently, less work is required in *your* mixer for complete dispersion. The result — lower heat build-up, less danger of scorching, and a shorter mixing period.

Also, the excellent processing features of RECLAIMATOR rubber carry over into the final compound and through all successive operations. This includes batching, warm-up, and extrusion. In all steps, less heat generation can be expected, and this means a better heat history for the compound.

Write for 4 page Folder.
Shows why RECLAIMATOR rubber should be in your compound.

U.S. **RUBBER RECLAIMING CO., INC.**
P. O. BOX 365 BUFFALO 5, N. Y.

new materials

Carbomix 3764 Oil-Black Masterbatch

Carbomix 3764, an oil-extended black master batch of low-structure ISAF black and COPO 1712, is now offered by Copolymer Rubber & Chemical Corp., Baton Rouge, La. The process used to produce this rubber requires no dispersing agent. The low-structure ISAF masterbatch offers low modulus and low hardness vulcanizates while maintaining good tensile strength. Carbomix 3764 is especially designed for use in tires and treads which are said to have a softer and quieter ride.

The composition of this masterbatch consists of: 100 parts mixed rosin and fatty acid emulsified polymer (COPO 1712-type base polymer); 60 parts low-structure ISAF black; 37.5 parts highly aromatic extending oil; and 1.25 parts staining stabilizer. Chemical data on the initial production run show 0.08% volatile matter and 0.15% ash content.

Some typical physical properties of Carbomix 3764, cured for 50 minutes at 292° F., are reported as follows:

Tensile, psi	3480
Elongation, %	830
300% modulus, psi	480
Compound viscosity, ML-4 @ 212° F. (uncured polymer)	58

Additional information and literature are available from the manufacturer.

Pliovic WO—Vinyl Dispersion Resin

Pliovic WO, a new vinyl dispersion resin produced by emulsion polymerization, is now available together with descriptive literature from the chemical division, The Goodyear Tire & Rubber Co., Akron, O. This vinyl chloride polymer is expected to find primary use in varied plastisol and organosol applications. Fabrication techniques to which Pliovic WO is especially suited include knife and roller coating, rotational and slush molding, dip coating, spray coating, gas pressure and chemical foaming, and other methods.

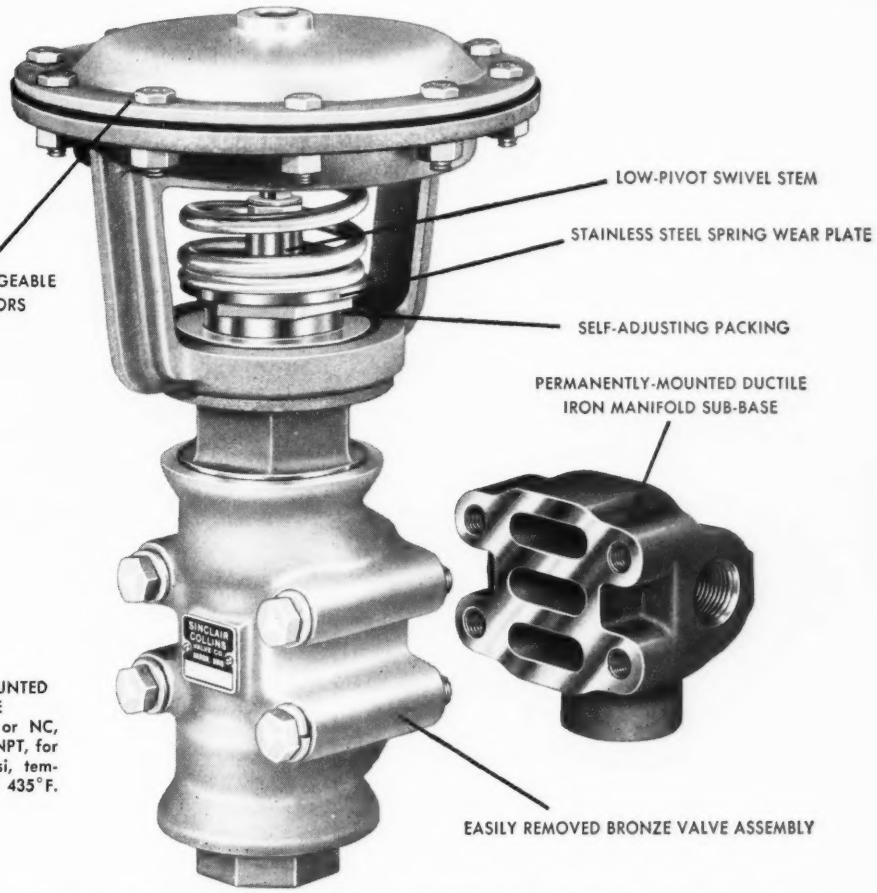
Special techniques used in the production of this resin yield a polymer low in residual catalysts and emulsifiers. This freedom from contaminants is said to be a highly desirable feature in vinyl dispersion resins. High purity lowers water sensitivity, improves heat and light stability, raises electrical properties, and increases adhesion characteristics of dispersions based on Pliovic WO.

The relatively high molecular weight of Pliovic

(Continued on page 44)

NEW—SINCLAIR-COLLINS

1/2" manifold-mounted steam valve


LOW-PIVOT SWIVEL STEM
STAINLESS STEEL SPRING WEAR PLATE
INTERCHANGEABLE OPERATORS
SELF-ADJUSTING PACKING
PERMANENTLY-MOUNTED DUCTILE IRON MANIFOLD SUB-BASE
S-C MANIFOLD-MOUNTED STEAM VALVE
2- and 3-way NO or NC, tapped ½- or ¾-in. NPT, for pressures to 350 psi, temperatures from 0 to 435°F.
EASILY REMOVED BRONZE VALVE ASSEMBLY

Want excellent flow characteristics and bubble-tight sealing? Want maximum service life and minimum downtime for maintenance? Want compact, versatile design and ease of installation? Then you'll specify Sinclair-Collins' new manifold-mounted steam valve.

S-C's low-pivot hollow swivel stem places the pivot point *within* the extra-long bearing area to minimize side thrust and wear . . . provides maximum packer life. Self-adjusting spring-loaded Teflon chevron packing requires no attention. Piloting of all assembled components eliminates misalignment of stem. These features, plus Sinclair-Collins' precision manufacturing techniques are your assurance of long trouble-free valve life.

What's more, S-C's new valve can be converted from NO to NC, or vice versa, by rotating it 180° on the manifold sub-base.

Some day, maintenance will be necessary . . . it's simple . . . just loosen four mounting bolts, remove the valve for later bench servicing and install a replacement . . . downtime can be measured in minutes!

Find out how this advanced design valve can improve the performance of machines you have in service or on the drawing board. Your Sinclair-Collins field engineer has all the details.

For more information, write for free Bulletin MV-60. Address The Sinclair-Collins Valve Company, 454 Morgan Avenue, Akron 11, Ohio, Dept. RW-760.

The SINCLAIR-COLLINS VALVE Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)
AKRON 11, OHIO

8128

EAGLE-PICHER

...an important source of lead and zinc compounds for the rubber industry

Eagle-Picher offers you a comprehensive line of both lead and zinc compounds, produced with highest quality control standards to your exact specifications.

Our customer service and research staffs are geared to answer your special needs . . . with courteous dispatch and resourcefulness.

Zinc Oxides	Litharge
Basic White Lead Silicate	Sublimed Litharge
Basic Carbonate of White Lead	Red Lead (95%-97%-98%)
Sublimed White Lead	Sublimed Blue Lead

EAGLE EP PICHER

Since 1843

The Eagle-Picher Company
Department RW-760
Cincinnati 1, Ohio

(Continued from page 42)

WO contributes to excellent strength and abrasion resistance. In addition, particle size and distribution make possible excellent plastisol flow properties for high-quality, uniform end-products, reports Goodyear.

Some typical properties of Pliovic WO are reported as follows:

Vinyl chloride content, %	100
Inherent viscosity	1.10
Specific gravity	1.40
Bulk density (packed), lb./cu. ft.	31
Particle size (avg.), microns	1-2

Synpol 8259A Oil-Black Masterbatch

Synpol 8259A, an oil-extended black masterbatch similar to Synpol 8255B, but having ISAF black instead of HAF black, is now available from Texas-U. S. Chemical Co., New York, N. Y. Synpol 8259A contains 75 parts of ISAF black and 50 parts of a highly aromatic-type oil per 100 parts of 8202-type polymer. The masterbatch is protected with 1.25 parts of a staining stabilizer per 100 parts of polymer. The emulsifier is mixed rosin acid/fatty acid soap, and the copolymer is acid coagulated.

Typical chemical and physical properties are reported as follows:

Volatile matter, % wt.	0.24
Ash, % wt.	0.28
Organic acid, % wt.	4.06
Soap, % wt.	0.09
Carbon black, % wt.	33.3
Compound viscosity, ML-4 (@ 212° F.	54.5
Tensile strength, psi. (50′ cure @ 292° F.)	3160
Elongation, % (50′ cure @ 292° F.)	660
Modulus at 500% elongation, psi.	
(25′ cure @ 292° F.)	550
(50′ cure @ 292° F.)	1150
(100′ cure @ 292° F.)	1570

A technical data sheet, No. 12 giving more detailed information and the test recipe, may be had from Texas-U. S.

ASP 106 Aluminum Silicate

An alumnium silicate product specially surface modified for improved performance as a reinforcing filler in polymer systems has been developed by Minerals & Chemicals Corp. of America, Menlo Park, N. J. Called ASP 106, the filler is said to offer faster cures and easier processing, the latter because of improved wettability and better dispersion due to its organophilic surface modification. In addition, in its initial applications the end-product has demonstrated improved modulus and tensile strength as well as better electrical insulating properties.

(Continued on page 48)

When rubber parts must deliver...

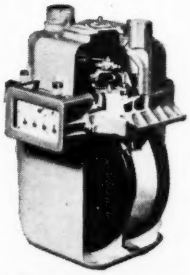
HIGH RESISTANCE TO SOLVENTS

LOW TEMPERATURE FLEXIBILITY

SUPER IMPERMEABILITY TO GASES

LONG, LIVELY LIFE

THIOKOL POLYSULFIDE CRUDES are PICKED FOR THE BIG JOB



REEVES BROTHERS, INC. USES THIOKOL polysulfide rubber in production of Reeves-Vulcan gas meter diaphragms. Its resistance to oils, organic solvents and impermeability to gases assure accurate metering.

High resistance to organic solvents, dilute acids, alkalies, and aromatic fuel. Impermeability to gases, moisture, liquids. Low temperature serviceability—to -60°F without plasticizers. Resistance to ozone, sunlight, weathering over long periods of time, without serious loss of serviceable properties.

Good reasons why THIOKOL polysulfide crudes are widely used in printing and coating rollers, solvent, paint and fuel hose, diaphragms and gaskets. Perhaps they hold the answer to improved product processing for you. Want the facts and technical assistance? Write to THIOKOL at address below.

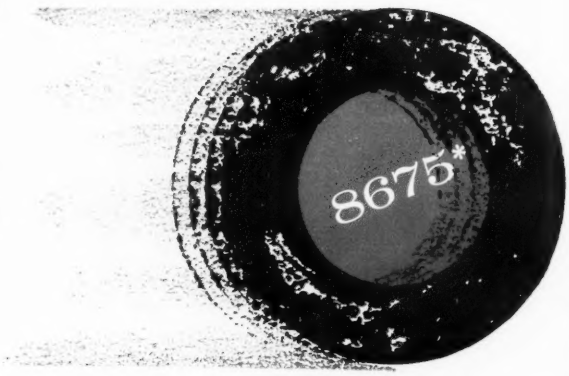
Thiokol **CHEMICAL CORPORATION**

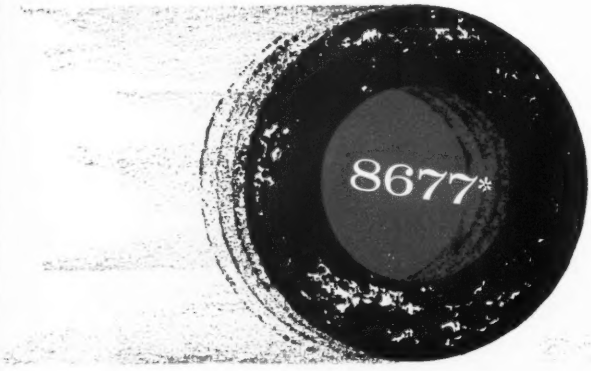
780 N. Clinton Avenue, Trenton 7, New Jersey

In Canada: Naugatuck Chemicals Division, Dominion Rubber Company, Elmira, Ontario

® Registered trade mark of the Thiokol Chemical Corporation for its rocket propellants, liquid polymers, synthetic rubber, plasticizers and other chemical products.

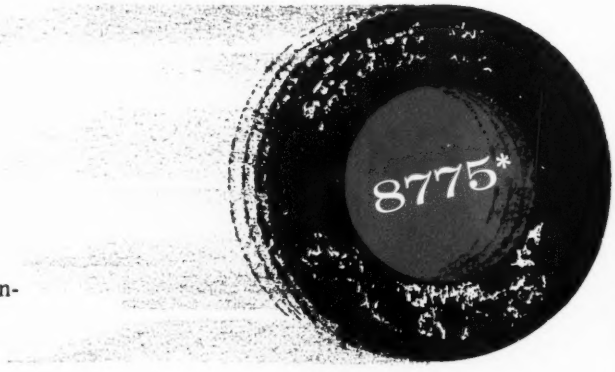
MORE MILES PER MIL





WITH THE NEW BAYTOWN MASTERBATCHES

Road test results prove new Baytown black masterbatches offer the highest tread wear ratings available.



10% higher tread wear ratings than conventional masterbatches.

BUT

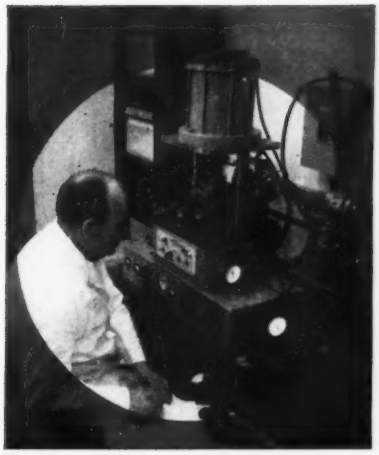
Tread wear is only one measure of masterbatch performance.

The new products combine the traditional Baytown black masterbatch uniformity, ease of handling and processibility with these improved tread wear ratings.

For more mileage on the road and in your plant, check on the new Baytown black masterbatches.

*ASTM Designation

MORE MILES PER MIL



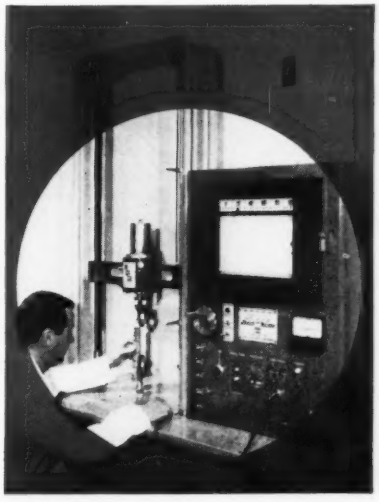
PLUS FINEST PROCESSING OF FIRST LINE TREAD

At the United Carbon Service Laboratory higher tensile results and lower Mooney values have been recorded.

8675 100 parts SBR copolymer
50 parts HAF black
9 parts naphthenic oil
rosin/staining

8677 100 parts SBR copolymer
52 parts HAF black
10 parts high aromatic oil
rosin/staining

8775 100 parts SBR copolymer
75 parts HAF black
37.5 parts aromatic oil
mixed/staining



BAYTOWN—THE BIRTHPLACE OF BLACK MASTERBATCH

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410 PARK AVENUE, NEW YORK 22, N. Y.

A Subsidiary of United Carbon Company

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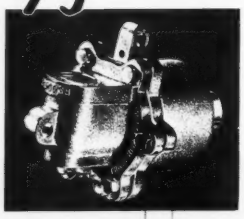
BOSTON HOUSTON MEMPHIS

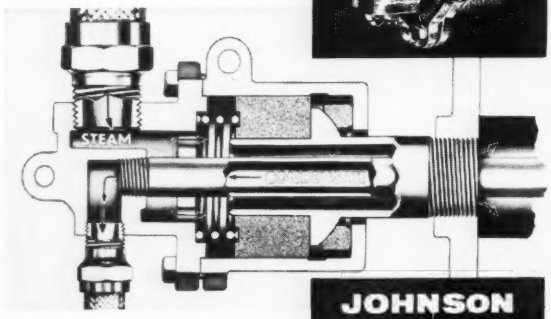
In Canada: CANADIAN INDUSTRIES LIMITED

UNITED CARBON

Need a rotary joint?

... for water-cooled or steam-heated rolls...





JOHNSON Rotary Pressure JOINTS

Type SB illustrated is completely self-supporting. For fully engineering data write for Bulletin S-3002.

Johnson started the whole idea . . . is far ahead in know-how, available types and sizes. Johnson Joints are completely packless, need no lubrication or adjustment. Used on dryer rolls, mills, waxers, calenders, slashers, printing presses, etc.—handling steam, water, hot heat transfer oils, Dowtherm, Mansanto Aroclors, etc. Actually serving under pressures as high as 2400 psi. Sizes up to 8".

THE JOHNSON CORPORATION
869 Wood St., Three Rivers, Michigan

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CHEMDYE RUBBER CORP.
331 MADISON AVENUE
NEW YORK 17, N.Y.
MURRAY HILL 7-3034

CHEMDYE

new materials

(Continued from page 44)

ASP 106 is derived from water-washed, water fractionated kaolins. Developed especially for use in rubber, the new material extends the company's line of surface modified products already in wide use.

ASP 106 is reported to have the following properties:

pH (Tappi Tent. Std. T645 M-54)	9.5-10.5
Particle shape	thin flat plate
Average particle size	0.55-micron
Residue, 325 mesh, maximum	0.01%
Color (GE brightness)	86-88%
Refractive index	1.56
Specific gravity	2.56
Bulking value	21.5 lb./gal.
	0.04653 gal./lb.
Free moisture, maximum	1%

Further information, including a typical test formula and vulcanizate properties, is available from the company.

technical books

(Continued from page 24)

"PVP Formulary." Booklet No. AP-98. General Aniline & Film Corp.'s Antara chemicals division, New York, N. Y. 22 pages. This booklet is a guide to new and improved products incorporating polyvinylpyrrolidone. Formulations are given for more than 30 specific products in five major groups—cosmetics and toiletries, pharmaceutical and veterinary products, soaps and detergents, adhesives, and coatings. Aerosol, aqueous, and organic solvent systems are described.

"Over 60 Chemicals for the Rubber Industry." Naugatuck Chemical Division of United States Rubber Co., Naugatuck, Conn. 20 pages.

"1960 Dry Processing Equipment Catalog." Sturtevant Mill Co., Boston, Mass. 8 pages.

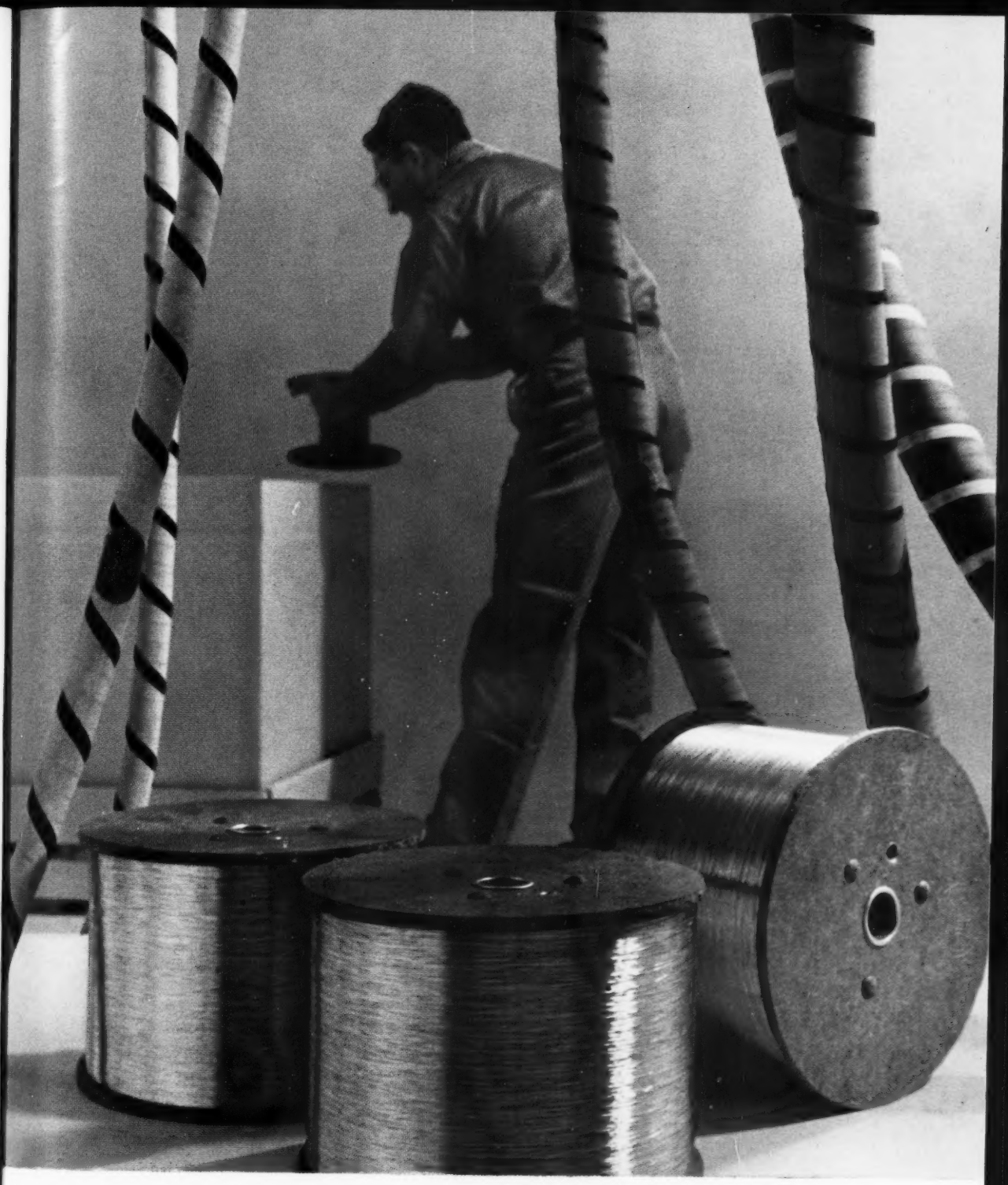
"Electron, X-Ray & Light Microscopy." Ernest F. Fullam, Inc., Schenectady, N. Y. 16 pages.

"Throttle Valves." Bulletin No. 460. Hose Accessories Co., Philadelphia, Pa. 4 pages.

"Industrial Trucks." 12 pages. **"Battery Electric Industrial Trucks."** 16 pages. **Industrial Truck Costs**—Gasoline and Electric Industrial Truck Cost Studies." 16 pages. **"Industrial Truck Costs**—Propane and Electric Industrial Truck Cost Studies." 16 pages. Exide Industrial Division, The Electric Storage Battery Co., Philadelphia, Pa.

"Garlock PK Mechanipak Seals." Bulletin AD-150. Garlock, Inc., Palmyra, N. Y. 8 pages.

"Industrial Ethyl Alcohol." U. S. Industrial Chemicals Co., division of National Distillers & Chemical Corp., New York, N. Y. 150 pages.



Roebling Hose Reinforcing Wire... The best things come in no-charge packages

When you buy Roebling Hose Reinforcing Wire it is delivered to you on no-charge spools that mean savings to you.

This modern method of packaging does away completely with deposits and the bookkeeping involved: it contributes, too, to lower freight costs and saves storage space. Thus, you avail yourself of a precision-made and quality controlled product, without any handling, shipping and inventory inconveniences.

Roebling Hose Reinforcing Wire, used for braiding reinforcement, is produced in a complete range of sizes. Write Roebling's, Wire and Cold Rolled Steel Products Division, Trenton 2, New Jersey, for details.

Roebling . . . Your Product is better for it

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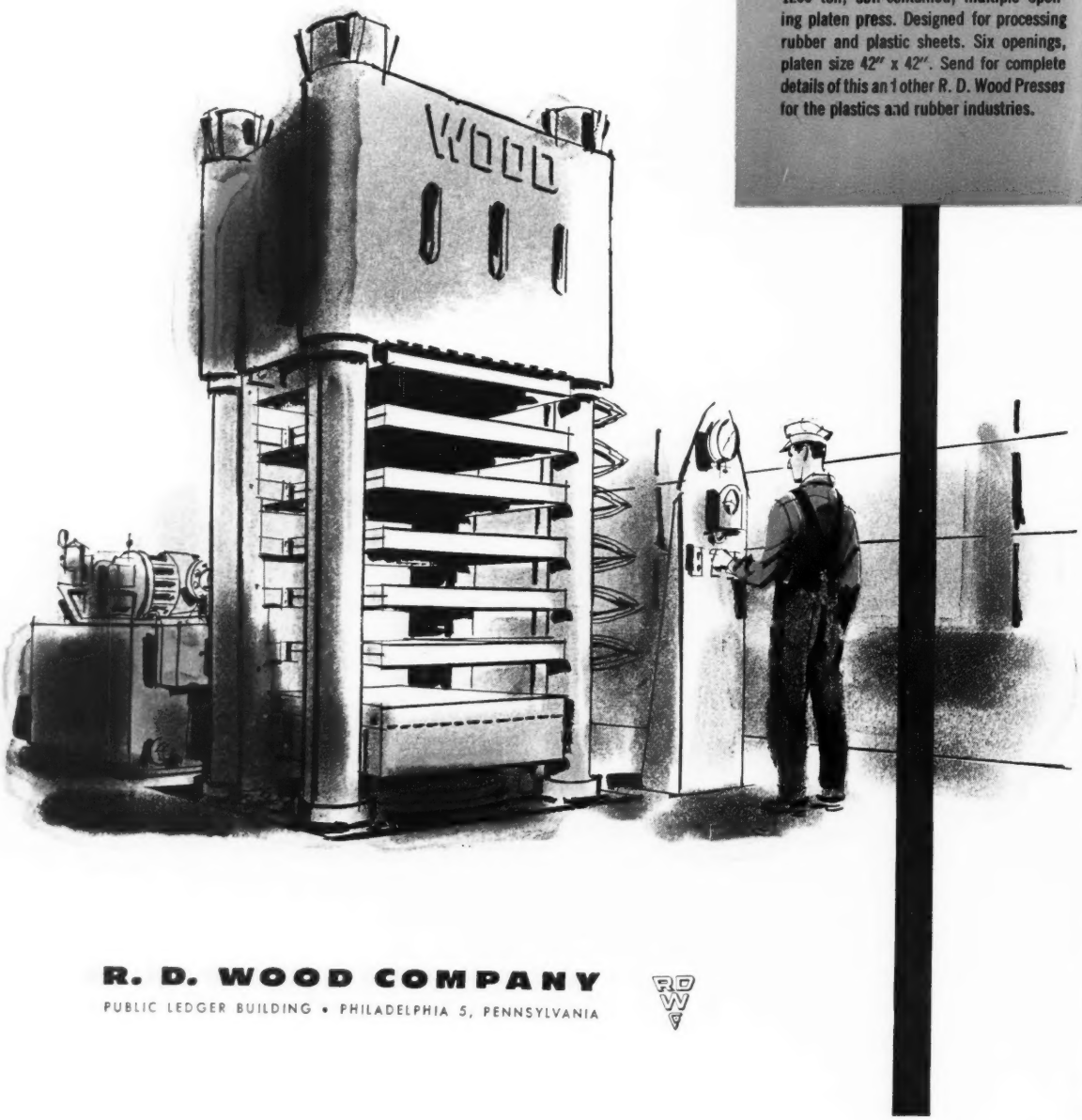
There's always a job for a Wood Press . . . and a Wood Press to do the job

When you want a production shortcut—or downtime and costs need cutting—there's a job for a Wood Press. And in almost every type of plastics or rubber operation, there's a Wood Press to do the job. R. D. Wood builds presses for such jobs as molding, curing, laminating, polishing and processing—besides designing and constructing others for special work. All have three things in common: sound design, carefully selected materials, conscientious workmanship. As a result, R. D. Wood Presses consistently deliver the utmost in smooth, dependable performance; fast, economical production; trouble-free operation. Write for catalog and engineering information—without obligation.

1200 ton, self-contained, multiple opening platen press. Designed for processing rubber and plastic sheets. Six openings, platen size 42" x 42". Send for complete details of this and other R. D. Wood Presses for the plastics and rubber industries.



R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA

Call Hall

HALLCO NEWS

Issued by
The C. P. Hall Co.
Chemical Manufacturers

No. 11

RECLAIM SCORCHED NEOPRENE WITH 4039-Y OIL!

For reclaiming and reconditioning scorched Neoprene, 4039-Y Reclaiming Oil is ideal for both scorched scrap and partly "set-up" stocks.* Tests show that it can also save time and production costs in the reclamation of regular rubber. Only 5% of 4039-Y Reclaiming Oil will completely recondition scorched Neoprene depending on how far such stocks have been set-up. 4039-Y treated stocks can be worked back into the original stock or used as a workaway in other stocks. General properties of 4039-Y Reclaiming Oil are as follows:

Specific Gravity @ 60/60° F.	0.938
Saybolt Universal Viscosity @ 100° F.	40 seconds
Flash Point, C.O.C.	180° F.
Weight per gallon in pounds	7.81
Color	Dark Brown

P.S. Use "Maglite D" in your Neoprene batches and avoid scorching!

NEW MAGNESIA CURES IN VITON® A ARE MAGLITES® Y, D AND M

Various grades of magnesia perform differently in Viton, producing varying degrees of activity related to specific surfaces. The end-use of the Viton product determines which Maglite is best.

With Viton A and 1.5 phr Diak No. 1 Maglite Y gives superior results for low compression set. . . . For non-supported articles in hot air service. . . . For parts exposed to di-2-ethylhexyl sebacate. . . . For general mechanical goods where best balance of properties are required for heat, hydraulic fluid, lubricant and fuel resistance. Maglites D or M are recommended for fabric coated or supported sheet for hot air applications.

They show little or no modulus increase, only slight increase in hardness and no loss in elongation during exposure to hot air. Loss of tensile strength should not be critical since they are supported. Both also give outstanding service in silicate-ester hydraulic fluid (MLO 8200) whether supported or not. Manufactured by: Merck & Company, Inc. Sold by: The C. P. Hall Co. For more complete details write for our new Bulletin #5821A entitled "Magnesia Cures in Viton® A."

VITON® A is a registered trademark of the E. I. duPont de Nemours Co.
MAGLITE® is a registered trademark of Merck & Company, Inc.

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CHEMICAL MANUFACTURERS

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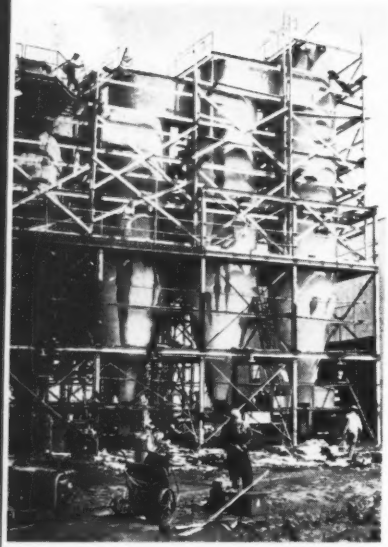
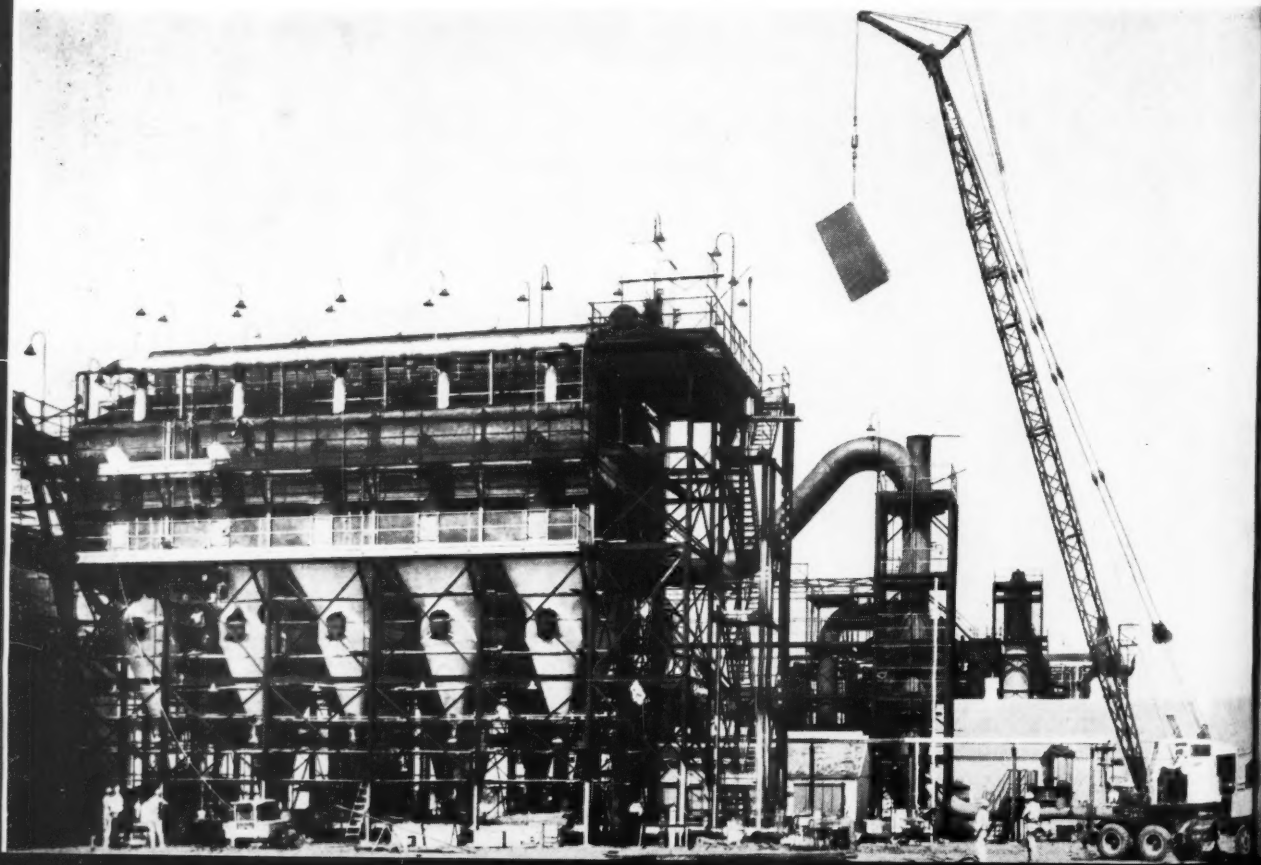
Expansion and Modernization Protect You



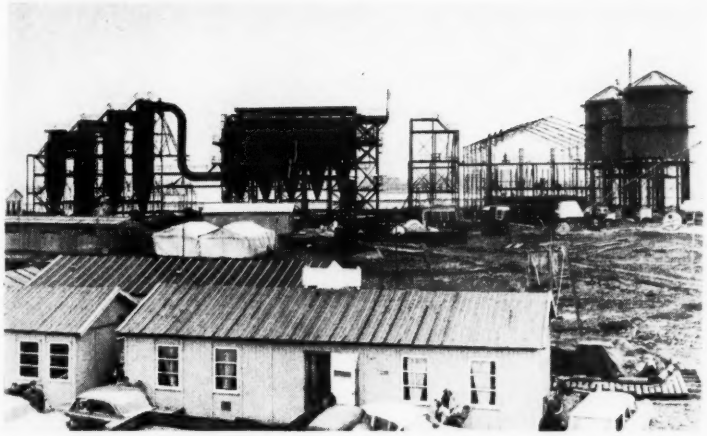
Louisiana: Newly completed production facilities for 25,000,000 lbs per year have just been brought on stream at Westlake to help meet the demand for premium quality carbon blacks.

The demand for quality carbon black by the rubber industry, both here and abroad, has reached a record-breaking level. And within the next few years, this demand is expected to increase even further. To keep pace with these carbon black requirements, Witco-Continental is engaged in a major expansion program to increase the Company's production capacity 50 per cent. New plants are being constructed in California, France and Italy, while a new plant in The Netherlands is now being completed. New additions also have recently been completed for present facilities in Oklahoma and Louisiana. Naturally, new laboratories are also being built to assure Witco-Continental customers the finest technical and other services.

Oklahoma: The new facilities which were added to the Ponca City plant in 1959 increased production at this site by 25,000,000 lbs per year. This new addition has fully instrumented production controls as do all Witco-Continental plants.



You ARBON BLACK DOLLAR at Witco-Continental



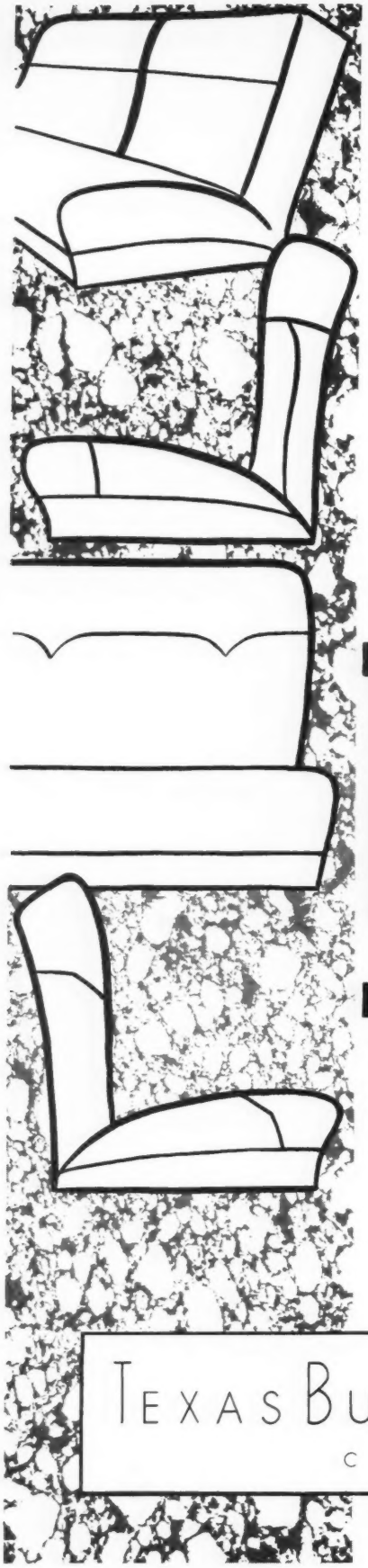
Europe: Steadily increasing demands for Witco-Continental carbon blacks have led the company to establish plants, laboratories, and sales offices on the Continent. A 30,000,000-lb-per-year plant is being completed at Rotterdam, The Netherlands, and soon will be on stream. A 56,000,000-lb-per-year plant is under construction at Bordeaux, France and a new 60,000,000-lb-per-year plant is under construction in Trecate, Italy.

California: The first carbon black plant ever to be built on the West Coast will be constructed by Witco-Continental. Located at Bakersfield, California, it will produce 30,000,000 lbs of oil furnace grade blacks per year. This photograph of the new oil furnace addition at Ponca City, Oklahoma is similar to the plant being constructed in California.

WITCO CHEMICAL COMPANY, Inc.
CONTINENTAL CARBON COMPANY

122 East 42nd Street, New York 17, N. Y.

Sales Offices in: Chicago • Boston • Akron • Atlanta • Houston • Los Angeles • San Francisco • Toronto and Montreal, Canada • London and Manchester, England • Glasgow, Scotland • Rotterdam, The Netherlands • Paris, France.



In Foam Rubber...

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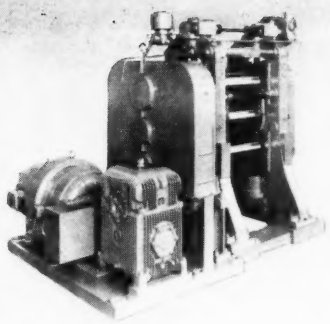
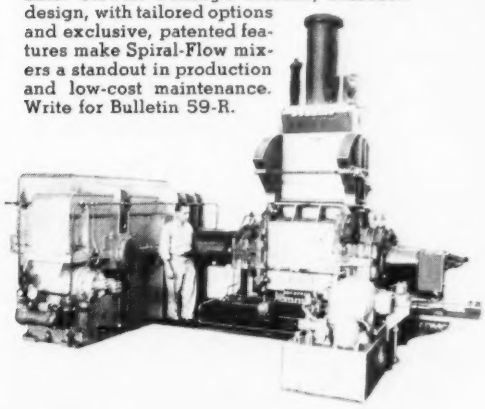


CALENDERS

Stewart Bolling calenders have long since established their worth by their dependable, rugged design, and versatility in use. Modern appearance, flexible design, and realistic cost enhance their use in any rubber manufacturing plant. 2-, 3-, and 4-roll standard and special calenders are offered, from 8" x 16" through 22" x 62". Write for catalog 58-M.

MIXERS

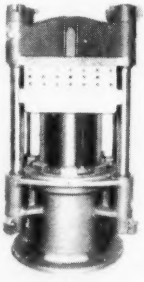
The Stewart Bolling Spiral-Flow intensive mixer line embraces a laboratory model, a lab-production size, and four production capacities, to fulfill any mixing requirement. Four types of drives can be furnished. Three kinds of discharge doors are available. Stewart Bolling's modern, seasoned design, with tailored options and exclusive, patented features make Spiral-Flow mixers a standout in production and low-cost maintenance. Write for Bulletin 59-R.

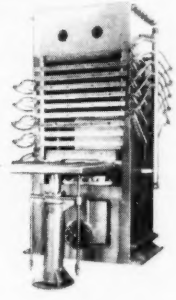


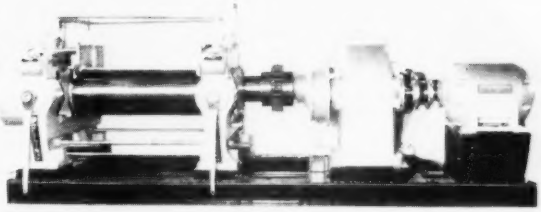
PRODUCTION and LABORATORY MACHINERY

PRESSES

Stewart Bolling compression and transfer molding presses in every usable size, in all basic types of construction, answer every practical need. Slab side presses range from 20" x 20" to 48" x 48"; 150- to 1250-ton pressures. 4-bolt line from 14" x 14" up; pressures 50 to 2500 tons. Also full- and semi-ring high pressure 22" x 22" to 48" x 48"; 500 to 2000 tons . . . Single- or multi-decked, steam or electrical heat. Massive, deflection-resisting for production with accuracy. Write for Catalog 58-P.







MILLS

The widest range of laboratory mills is now presented by Stewart Bolling. ULTRA, deluxe and standard models start with a 2½" dia., 7" wide roll mill. Eleven sizes in all are topped by the 26" dia., 100" wide roll mill. Special requirements can be met in roll speeds, lengths and widths. Stewart Bolling also has direct-connected drives, shown above on a 60" roll mill. All Stewart Bolling mills are described in Catalog 58-M.

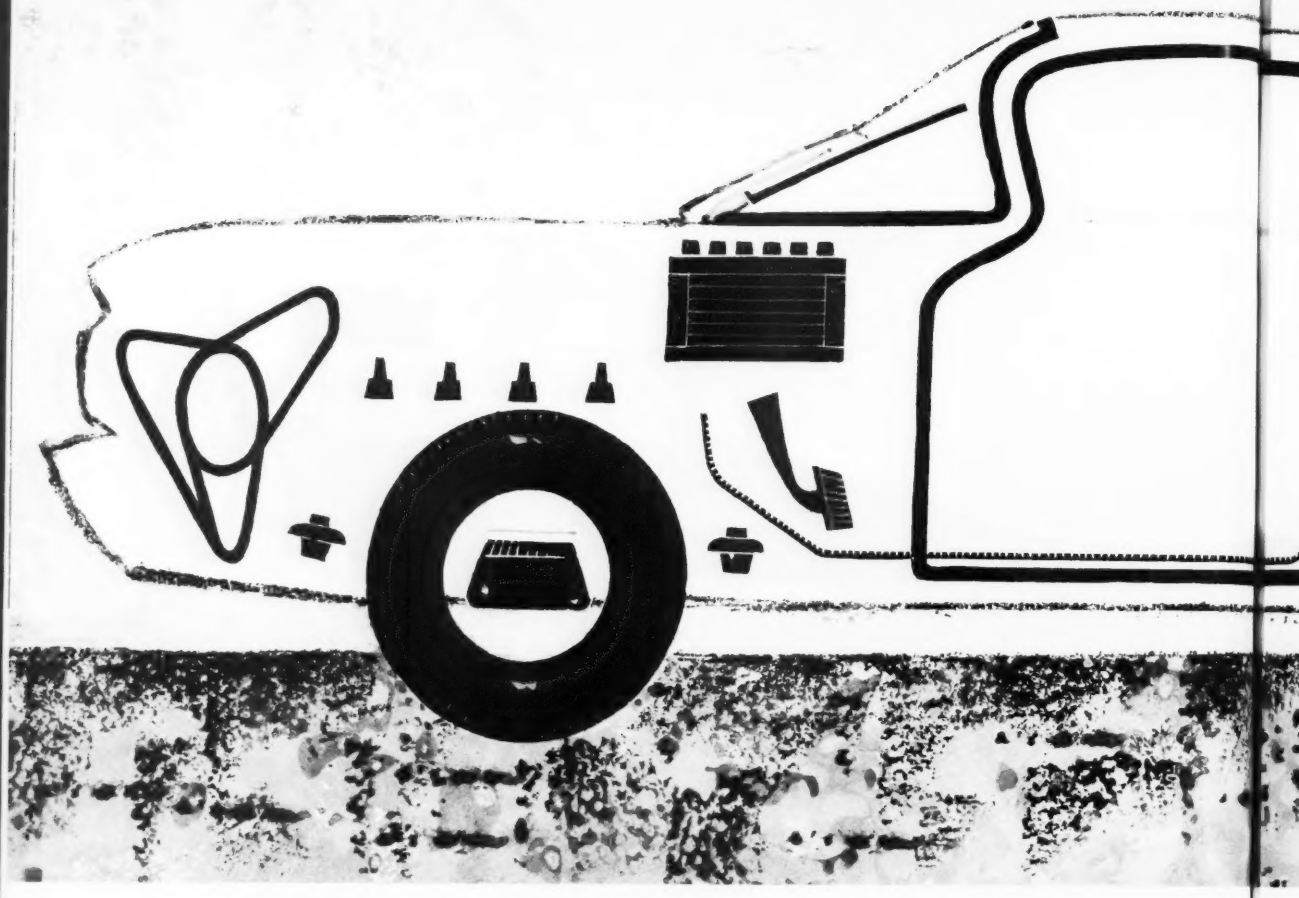
Stewart Bolling

& Company, Inc.

3190 EAST 65th STREET • CLEVELAND 27, OHIO

Designers and Builders of Machinery for the Rubber and Plastics Industries

Intensive Mixers • Calenders • Mills • Refiners • Crackers • Dust Grinders • Sheeters
Hydraulic Presses • Pump Units • Accumulators • Elevators • Bale Splitters • Vulcanizers
Speed Reducers • Gears • Extruders



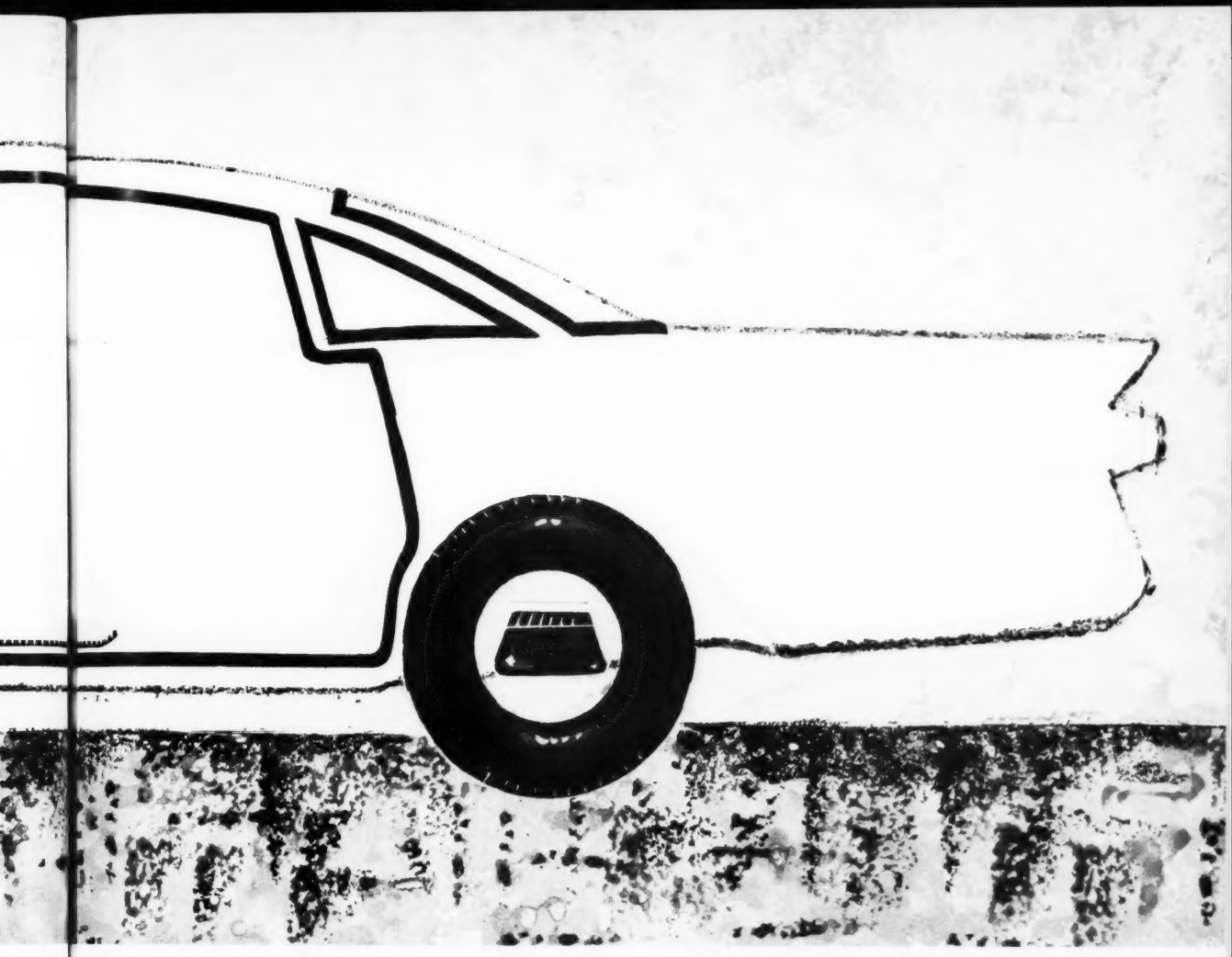
THERE'S TEXUS ON THE GO!

TEXUS gives manufacturers of automotive components greater variety and high quality in a wide range of SYNPOLS!

Clear hot, cold and oil-extended SYNPOLS offer property ranges that enable the manufacturer to select the polymer that meets his exact requirements for cost, processing and performance.

SYNPOL black masterbatches provide substantial savings in Banbury time, power consumption, equipment wear. They help create tougher, more durable products . . . and with seven distinct types of SYNPOL black masterbatch, you can employ all your compounding skills and mix to your customers' exact specifications.

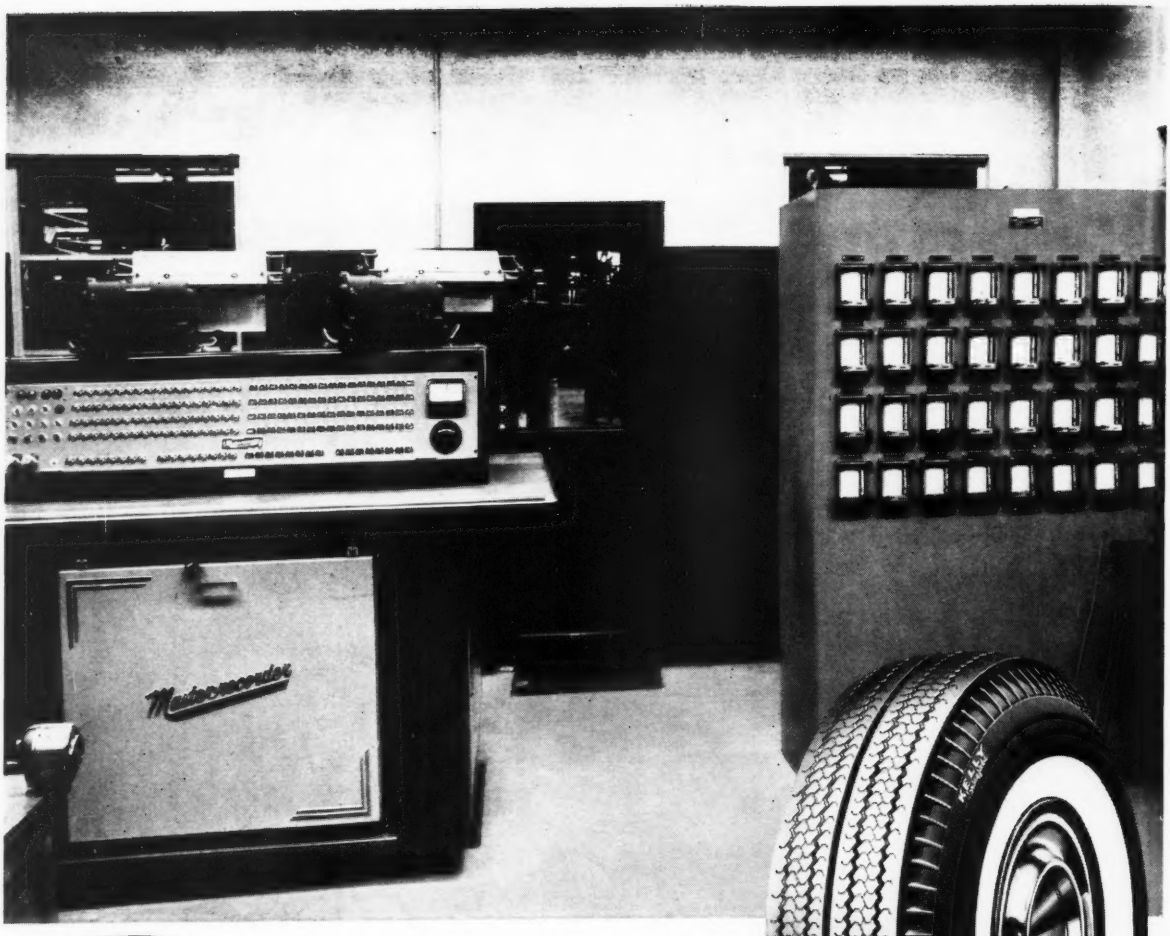
For full technical information, please write TEXUS, 9 Rockefeller Plaza, New York 20, N. Y., or call JUdson 6-5220.



WHICH SYNPOL® FITS YOUR NEEDS?		
HOT TYPE POLYMERS	**1000, 1002, 1006, 1061**	Original SBRs for a wide variety of applications featuring easy processability.
COLD TYPES	**1500, 1551, 1502**	For applications requiring the quality improvements associated with "cold" SBR.
COLD OIL-EXTENDED TYPES	**1708, 1712, 8201, 8202**	For the maximum in high quality at lower cost.
BLACK MASTERBATCH	**8151, 8253, 8255, 8267**	Ready-to-use SYNPOLS save mixing time and achieve greater uniformity.

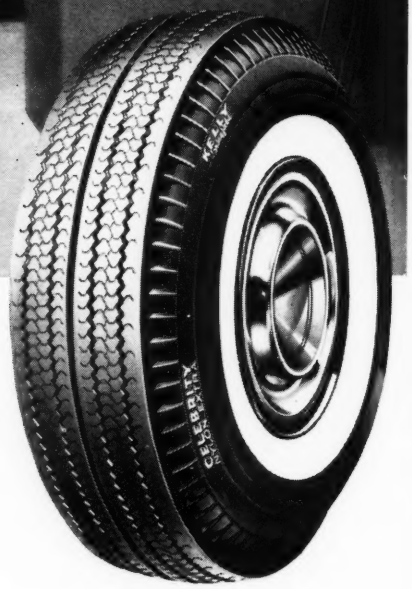
TEXUS *Pace Setter in Synthetic Rubber Technology*

TEXAS-U. S. CHEMICAL COMPANY, 9 Rockefeller Plaza, New York 20, N. Y. JUdson 6-5220



KELLY Springfield TIRES **BUILDS QUALITY...**

AND MAINTAINS IT WITH *Taylor* QUALITY CONTROL SYSTEM!



Pictured is the new Taylor Master-recorder* System, in use with McNeil Automatic Loading Bag-O-Matic presses at The Kelly-Springfield Tire Company's Cumberland, Md., plant.

The first of its kind to be used in the industry, the Master-recorder System helps insure uniform quality by detecting minute variations in the vulcanizing temperatures that might affect tire quality. It automatically checks each of 68 presses and 8 headers every six minutes. Should the temperature exceed or fall below that prescribed, an alarm is sounded and a signal light appears on the console, identifying the press or header. (See scanning and logging system at left of photograph). Off-normal conditions are typed in red on logging chart. The panel of Taylor TRANSET* miniature recorders on the right logs the actual bag pressure and cure cycle time. This provides a chart record of the curing cycle for the future reference of operators and quality control men.

With this centralized information system, rejects are kept to an absolute minimum and operator time is reduced. Since any malfunction can be detected almost immediately, the maintenance problem is greatly simplified.

Call your Taylor Field Engineer for more information about this latest Taylor development. Or write Taylor Instrument Companies, Rochester, New York or Toronto, Ontario.

The Master-recorder System is a product of Taylor-Emmett Controls, Inc., a subsidiary of Taylor Instrument Companies.

*Trade-Mark

***Taylor Instruments* MEAN ACCURACY FIRST**

NATIONAL ANILINE

RUBBER PROCESSING CHEMICALS

ANILINE
MALEIC ANHYDRIDE
SUCCINIC ANHYDRIDE
ADIPIC ACID
FUMARIC ACID
CAPROLACTAM
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HEXAHYDRO PHTHALIC ANHYDRIDE
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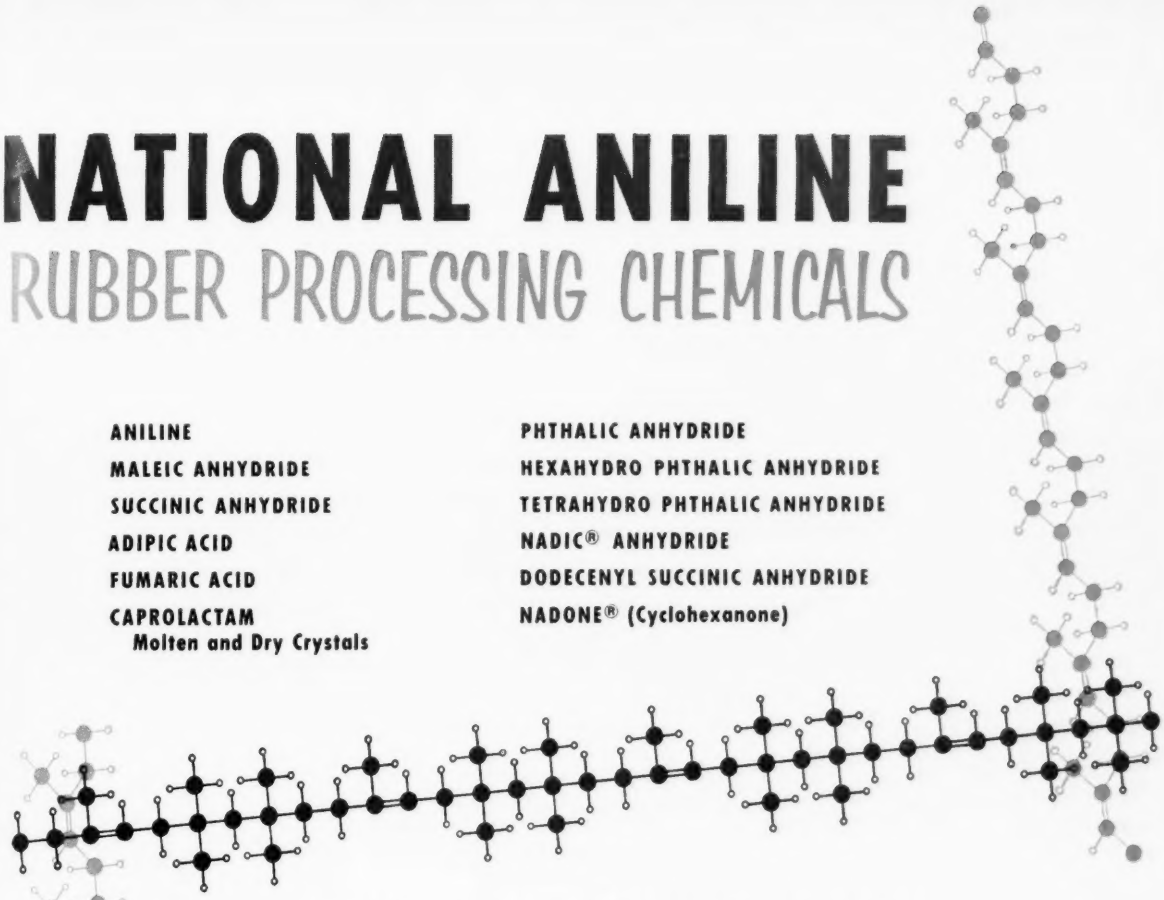
NADIC® ANHYDRIDE
DODECENYL SUCCINIC ANHYDRIDE
NADONE® (Cyclohexanone)



AND FOR POLYURETHANES

NACCONATE® Diisocyanates

NACCONATE 65
Isomeric mixture of approximately 65% of 2,4-tolylene diisocyanate and 35% of 2,6-tolylene diisocyanate.

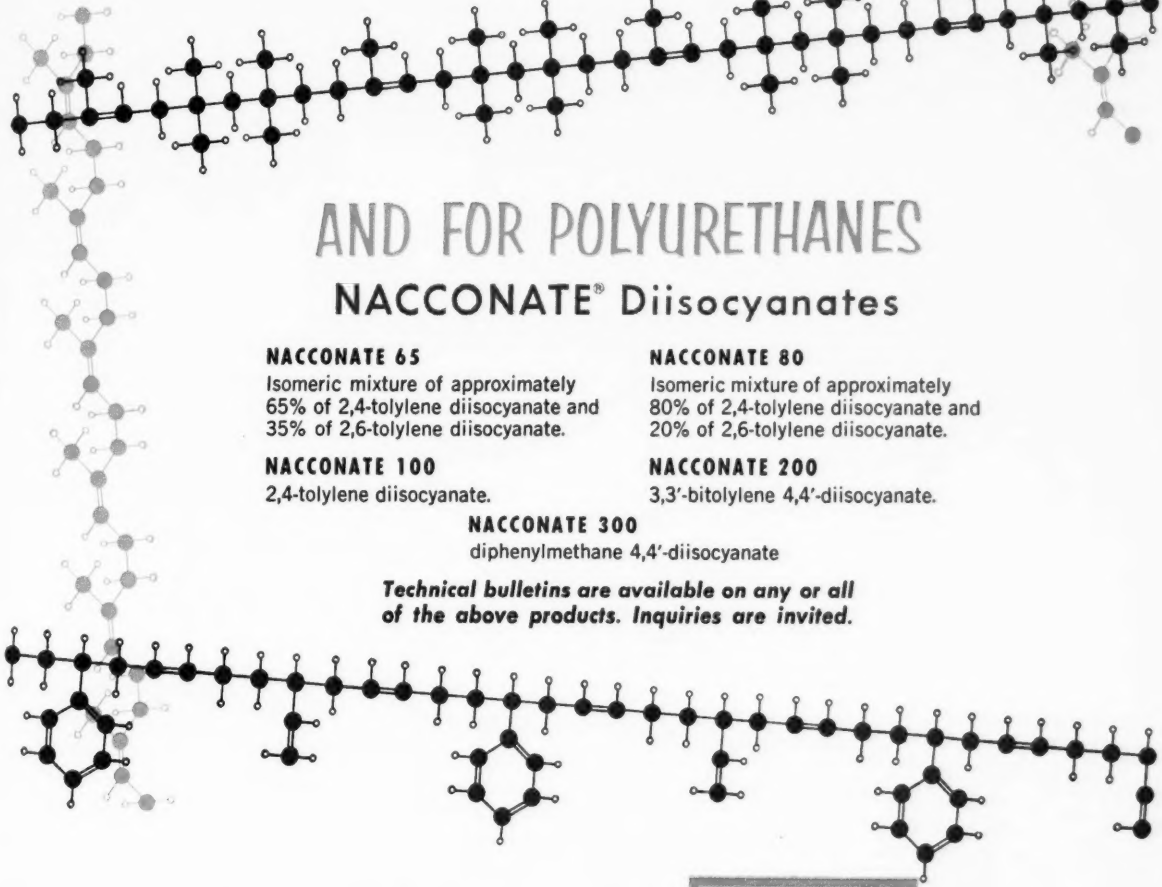
NACCONATE 80
Isomeric mixture of approximately 80% of 2,4-tolylene diisocyanate and 20% of 2,6-tolylene diisocyanate.

NACCONATE 100
2,4-tolylene diisocyanate.

NACCONATE 200
3,3'-bitolylene 4,4'-diisocyanate.

NACCONATE 300
diphenylmethane 4,4'-diisocyanate

Technical bulletins are available on any or all of the above products. Inquiries are invited.



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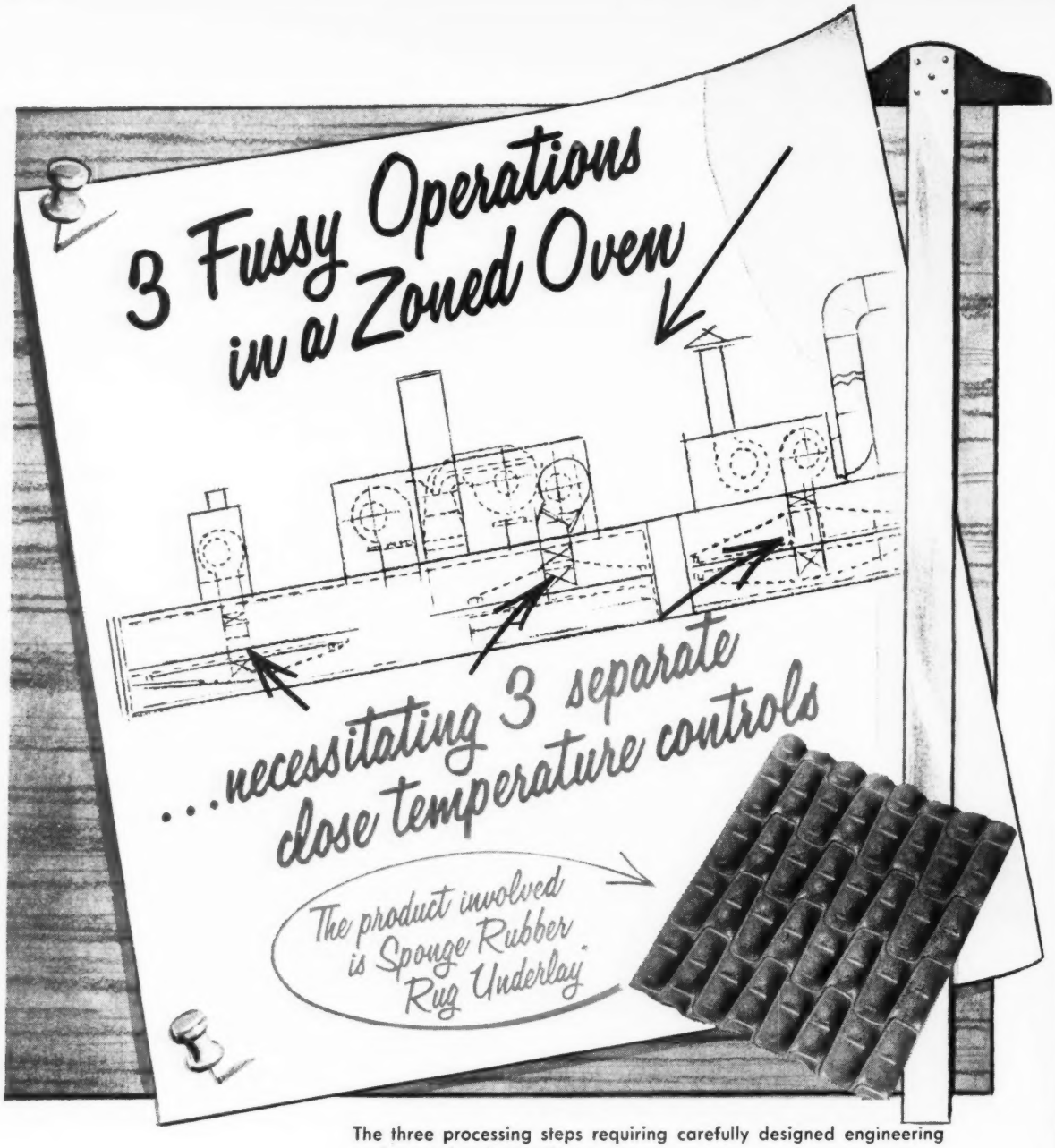
3 Fussy Operations in a Zoned Oven
...necessitating 3 separate close temperature controls
The product involved is Sponge Rubber Rug Underlay*

The three processing steps requiring carefully designed engineering and operational controls are:

1. **...creation of conditions to induce just the right 'sag' for developing the waffle pattern.**
2. **...'blow' which causes the chemicals in the rubber mix to produce expanding gases which, in turn, create the sponge consistency.**
3. **...curing of the rubber.**

In these zones, temperatures of the entering hot air must be kept within ±5°F. Temperatures on the work itself are held to ±3°F.

It would be difficult to find a more exacting problem in dryer/oven design. It was a job that called for more than 'rule-of-thumb' talents in design and construction.

*Manufactured by The Mansfield Tire & Rubber Co., Capistrano Beach, Calif., for Orcco Industries, Inc.

In addition to this multi-zone dryer/oven unit, Ross Engineers designed a Direct Flame Fume Incinerator to eliminate the odor and smoke from the oven operations.

J.O. ROSS ENGINEERING

A Division of Midland-Ross Corporation/730 Third Ave., New York 17, New York

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ENDICOTT JOHNSON Corp.

uses SILENE EF

in its **SOLING STOCK** because it has

- excellent reinforcing qualities

and imparts

- abrasion and tear resistance
- increased hardness and flexibility

This Endicott Johnson worker wears E-J Safety Shoes as he adds SILENE EF to a batch of soling stock.

SILENE EF, a precipitated hydrated calcium silicate of very fine particle size, maintains exceptional color quality in GR-S, Nitrile, Neoprene and Vinyl, while providing greater reinforcement, elongation and tensile strength. As an acid acceptor and heat stabilizer, SILENE EF can be used in Vinyl films and sheet stock without reduction of physical properties or translucency of film.

Manufactured by Columbia-Southern Chemical Corp.

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COLUMBIAN'S

NEOTEX®

FOR TOMORROW'S

NEOTEX 100

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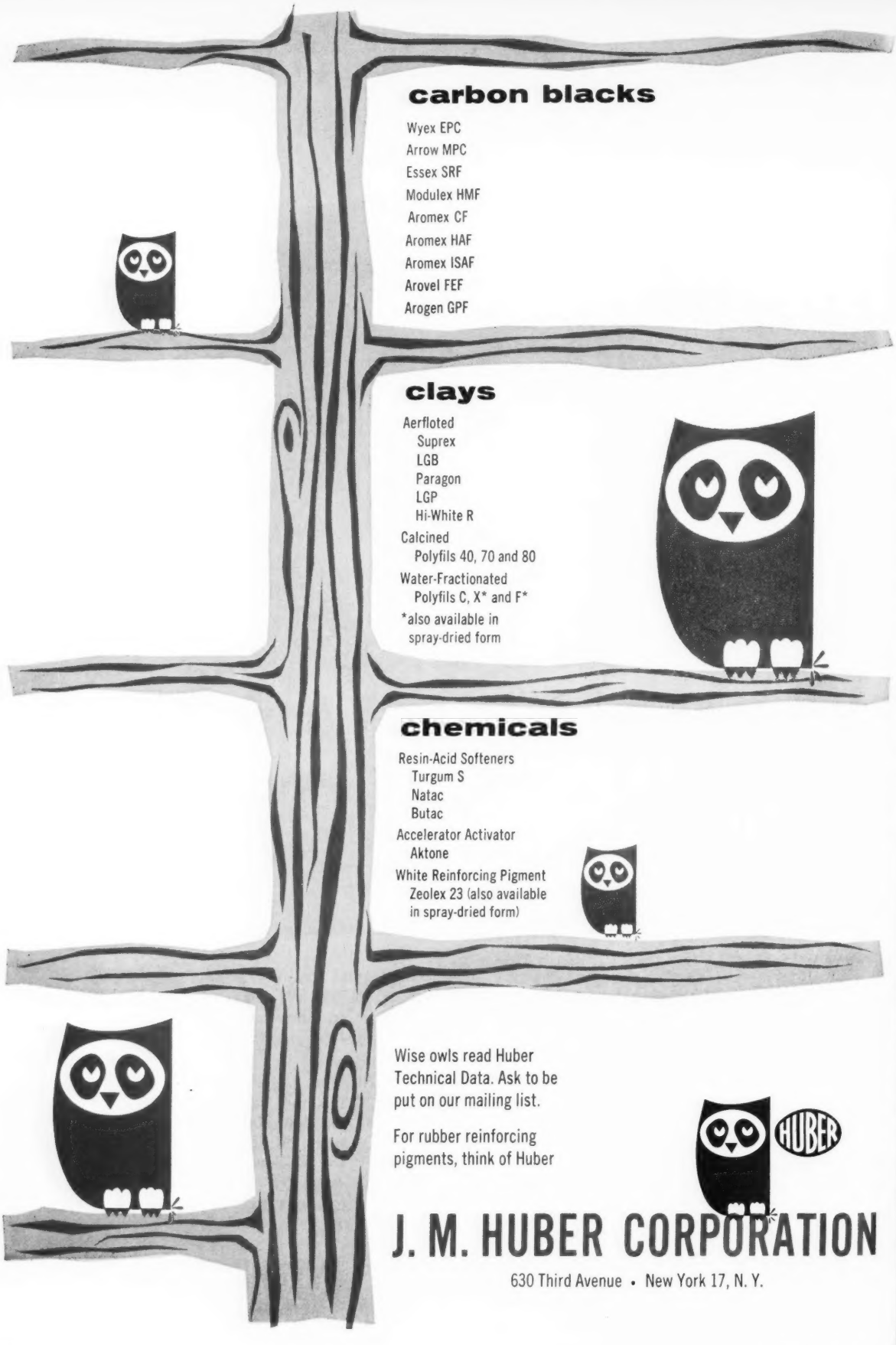

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editorial

Government Rubber Industry Statistics; Are They in Need of Improvement?

Statistics on the rubber industry from the Federal Government have always been provided from several of its bureaus, but have become increasingly difficult to interpret in the recent past. It might be desirable for a joint government-industry committee to review this situation in the near future to determine if any improvements could and should be made.

In 1957 the Bureau of the Budget revised the 1945 edition of the Standard Industrial Classification (SIC) Manual of definitions of industries, and, as a result, the "Rubber Products Industry" became the "Rubber and Miscellaneous Plastic Products Industry." Statistics on many of the products of the plastics industry are now lumped together with those of the rubber industry.

In addition to statistics collected by the Commerce Department's Census Bureau in its periodic Census of Manufactures, those of the Federal Trade Commission and the Securities Exchange on sales and profits, and those of the Federal Reserve Board's Index of Production are now all based on both rubber and plastics products. Neither industry has as clear a picture of its position, as before. Meanwhile, the Bureau of Labor Statistics reports number of production workers, average hourly earnings, and average weekly hours worked on rubber products according to the 1945 SIC definitions, however.

Statistics on production, shipments, and value of rubber and miscellaneous plastics products from the 1958 Census of Manufactures are now being reported. Although the forms used for this census were based on the 1957 SIC, the first preliminary reports use the 1945 SIC and deal with products made from rubber only. The final reports are to be based on the 1957 SIC and will include data on both rubber and plastic products.

It is hoped that the final reports will provide data on products made from rubber separately from those made from plastics; otherwise the figures may be of limited value to both industries. If not, it may be possible to arrive at separate figures for some plastic products by subtracting the figures for the same products made of rubber, as given in the preliminary reports.

In the field of rubber production and consumption, the United States Tariff Commission, in its preliminary annual report issued in May on "United States Production and Sales of Elastomers—1959," has for the first time provided figures on polyurethane and silicone-type elastomers. Such action, long overdue, represents a step forward in making more complete data on elastomers available.

Unfortunately, the production of polyurethane-type elastomers of 2,377,000 pounds, or about 1,060 long tons, given in the report represents only solid polyurethane and does not include data for polyurethane used in the production of flexible foam. Although difficult, some provision for collecting data on this use in flexible foam should be attempted.

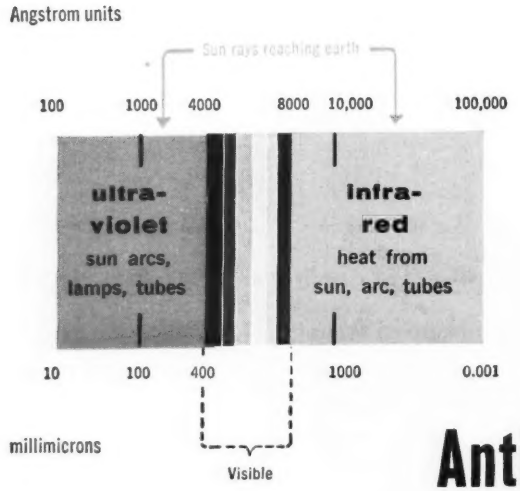
The Tariff Commission reported that its figures for styrene-butadiene, nitrile-butadiene, butyl, and neoprene were compiled with the Census Bureau. If the Tariff Commission has broken the ice on collecting statistics on solid polyurethane and silicone elastomers, why can't the Census Bureau follow this lead and work toward including statistics on these new elastomers in its monthly report on "Rubber-Supply and Distribution for the U. S."

There is also the planned production within the next two or three years of 150,000 to 200,000 long tons yearly of polybutadiene and polyisoprene, and plans should be made now for providing statistics on these elastomers.

In view of this partial review of the problem of industry statistics, an industry-government reexamination of the situation would seem desirable.

R. G. Seaman

EDITOR



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Current Topics In Rubber-To-Metal Bonding[1]

Cleanliness of metal surfaces, improvements in adhesion testing, the trend toward one-coat chemical adhesion systems, and the necessity of matching the cement and the stock for good adhesion, are of major importance

By STEWART L. BRAMS

Dayton Chemical Products Laboratories, Inc., West Alexandria, O.

IN THE years since the close of World War II the art of rubber-to-metal bonding has been improved upon substantially; however, it is still an art. The scientific background of technologists concerned with the development and the use of bonding agents certainly has been most valuable and has resulted in the availability of better bonded assemblies and at a lower cost. Nevertheless, empirical methods and observations are still most useful.

A comprehensive or thorough discussion of all aspects of rubber-to-metal bonding will not be attempted in this paper, but rather a discussion of certain phases of the empirical art which are of importance in this type of work and of some newer developments which recently may have changed the picture will be undertaken.

Metal Preparation

Proper metal preparation, while long recognized as very important in rubber-to-metal bonding, has again engaged the attention of technologists working in the field recently. Two distinct lines of attack have been the result. On the one hand, is the search for less expensive and more efficient methods of cleaning metal surfaces, and, on the other, are efforts to obtain more efficient bonding agents which would function effectively with less expensive metal preparation. Until some new super bonding agent is developed, however, proper metal prepa-

[1] Presented before the Northeastern Section, Elastomer & Plastics Group, ACS, Boston, Mass., Apr. 19, 1960.

The Author

Stewart L. Brams, president and general manager, Dayton Chemical Products Laboratories, Inc., received his B.S. degree in chemistry from the University of Michigan in 1935 and his M.S. from the same university in 1936.

He was employed by Minnesota Mining & Mfg. Co. in Detroit, Mich., in 1937 and 1938 and by the Inland Mfg. Division of General Motors Corp., Dayton, O., as a senior compounder and section head between 1939 and 1946. He founded Dayton Chemical Products Laboratories, Inc., in 1946.

Mr. Brams is a member of the American Chemical Society and its Division of Rubber Chemistry, American Society for Testing Materials, the French Association of Rubber Engineers, Southern Ohio and other rubber groups, Engineers' Club of Dayton, Phi Lambda Upsilon, and the Kiwanis of West Alexandria, O.

Stewart L. Brams

ration appears to be the key to good rubber-to-metal adhesion, with cleanliness of the metal surface probably the most important single factor involved.

The standard industrial practice for good preparation of metal surfaces for bonding continues to be blasting with steel grit, in which the proper size and sharpness of the particles are critical factors. To be most effective, gritblasting must abrade the metal surface, take away scale and oxides and other surface impurities, and leave exposed a mechanically clean and fresh surface.

When steel grit of large particle size is used for any appreciable length of time, the sharp corners of the particles break off and are carried away in the dust collector. The remainder of the particles look like eccentric BB shot; and while their use produces a shiny surface on the metal, the action is more one of peening than abrading. The use of grit of small particle size usually provides more of an abrasive action; and when the sharp corners of these particles are broken off, the rest of the particle tends to be blown with the broken pieces into the dust collector, thus requiring occasional replenishment, but not complete replacement.

Sandblasting has been used and is often satisfactory, but it seems that the industry prefers gritblasting for metal surface preparation. Abrasive mineral particles have been used also, and wet blasting or "vapor blasting"[2] processes have been applied with success. It cannot be emphasized too often, however, that good blasting and abrasion of the metal surface with fresh grit make possible the best quality rubber-to-metal bonding.

Another mechanical method of preparing metal for bonding is by the use of a surface grinder, and it has been found that a fine ground surface prepared in this manner will provide for as good adhesion as can be obtained with the best blasting methods, which fact would indicate that an increase in surface area is not the major reason for the success with blasting. We may assume that the grinding process does what we try to accomplish with blasting, that is, removes the oxide and impurities and provides a fresh, more-or-less natural metal surface.

Under the heading of physical cleaning methods we may also consider ultrasonic cleaning.[3] A metal surface which looks clean may not give a good bond under certain conditions. Degreasing and detergent cleaning alone may provide for a certain amount of rubber-to-metal adhesion, but such bonding is usually not sufficient for quality parts. If this same surface is subjected to a detergent bath at elevated temperature while the solution is subjected to an adequate source of ultrasonic vibration at the same time, the metal piece will, in many cases, come out with a surface capable of producing a high-quality bond with rubber. We may assume that the use of ultrasonic vibrations adds something to the action of the detergent at the surface of the metal which provides for a more satisfactory surface than the action of the detergent alone.

Ordinary detergent cleaning or degreasing is usually considered to be a lower-quality metal preparation method unless ultrasonic vibrations are used at the same time. Where the bonding specifications are not too high, or where the efficiency of the bonding agent is exceptionally good, certain commercial parts can be processed satisfactorily, however, by simple detergent cleaning or degreasing.

There is another piece of evidence pertinent to the consideration of metal preparation for rubber-to-metal adhesion. We can use a chemical method to secure a new physical surface, that is, we can iron-plate a piece of steel to be used as the insert or as a test-piece insert and obtain exceptionally good bonds with rubber. Iron-plating of steel and ultrasonic cleaning are both strictly laboratory methods, however, for although good bonds can be obtained, it is usually accomplished at a greater expense than by other methods.

Chemical metal cleaning methods include the use of acid etching, and the preparation of a new surface by deposition of, for example, a phosphate coating, or plating methods as mentioned above. Acid etching, using inhibited or uninhibited acids, is perhaps a little dangerous; yet this method has been used successfully with thin parts that will not stand blasting; nevertheless, acid etching is a method which is probably best avoided whenever possible.

Interest in the use of deposited phosphate-base coatings has grown in recent years since, where a phosphating system can be worked out using conveyorized racks for dipping the metal parts, they then can be washed and dried and spray cemented with but a single handling of the part. This method is being used on a significant number of parts and has earned its place in the field by virtue of the cost reductions possible and the quality of the production obtained.

It is the opinion of this writer, however, that better adhesion can be obtained with a well-blasted part rather than a chemically coated part, and that in certain cases a one-coat bonding system can be used with blasted parts where two coats are required to get comparable results with the chemically coated part. For many items adequate quality has been achieved with the phosphate coating system, however, and significant production economies have been achieved through the use of this system.

In summarizing factors involved in the production of rubber-to-metal items of high quality, it must be remembered that there are all degrees of metal preparation between satisfactory and optimum, and that there are many factors involved in the formulation of the rubber stock, molding, requirements of the parts, and other conditions that affect the end result. The quality of metal preparation is common to all rubber-to-metal problems, and it has been the writer's experience that occasional adhesion problems encountered in a particular system can very often be rectified by improving the quality of the preparation of the metal surface. Also, when we consider the evidence presented above with regard to metal preparation methods, that is, coarse, rounded grit *versus* fine, sharp grit, grinding *versus* degreasing, ordinary detergent cleaning *versus* ultrasonic detergent cleaning, and bondability to an iron-plated surface, we may draw one important tenta-

[2] "Liquid honing," Vapor Blast Mfg. Co., Milwaukee, Wis.
[3] Branson Ultrasonic Corp., Stamford, Conn. Model AP-25-B ultrasonic generator, with TH-60 transducerized tank used.

tive conclusion. There is no magic about metal preparation for adhesion; it is simply a matter of cleanliness of the metal surface.

Adhesion Testing

The subject of testing of bonded assemblies is one that has always been of interest and is currently commanding considerable attention; in fact, it has never ceased to command attention and interest since the first parts made were bonded to meet certain specifications.

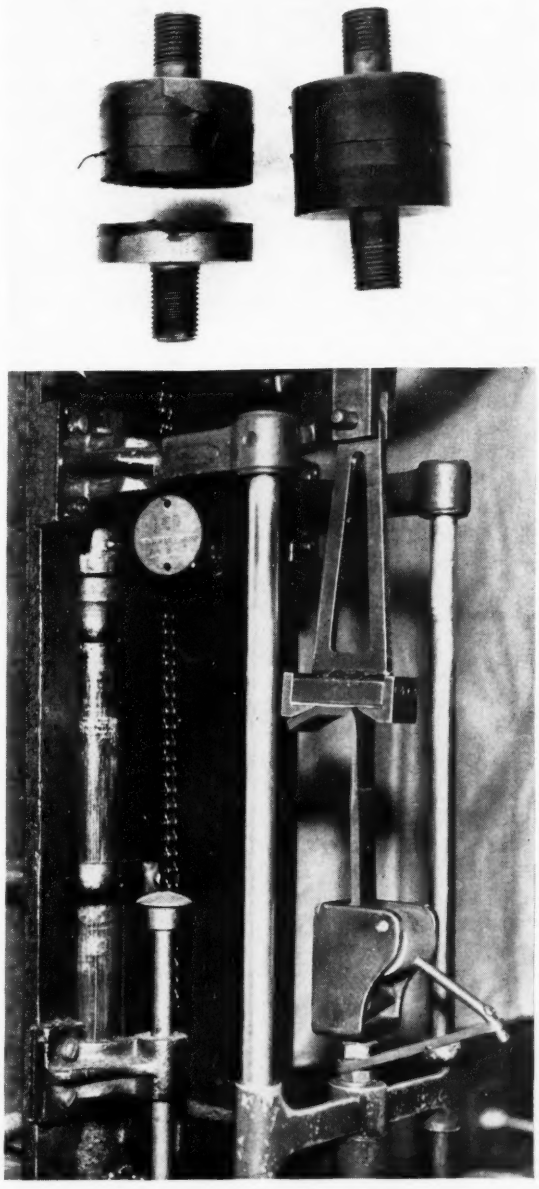


Fig. 1. ASTM methods for testing adhesion of rubber to metal; *top*, tension test specimen or button; *bottom*, strip test specimen in special fixture on tensile testing machine. *(Bottom photograph courtesy of ASTM)*

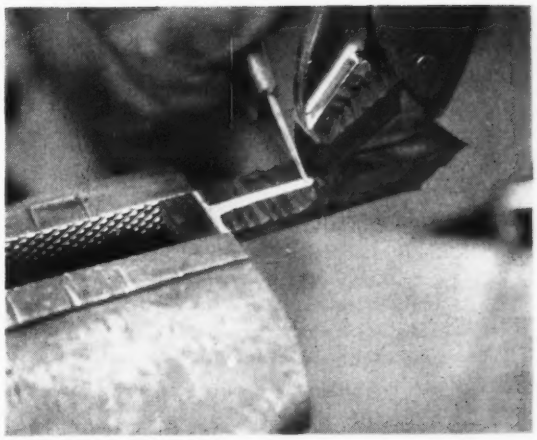


Fig. 2. Hand-cut-and-strip test for evaluation of the rubber-to-metal adhesion bond

In the present instance it may help to repeat some obvious observations. The entire purpose of laboratory testing of bonded assemblies, as well as any other type of laboratory testing, is to determine rapidly and inexpensively whether a part, a structure, a process, or what-have-you, will function satisfactorily in an actual application.

The testing of rubber-to-metal bonding systems is beset with inconsistencies and difficulties. Efforts have been made over the years to devise and execute laboratory tests which will ascertain the capacity and efficiency of a bonding system without making actual production parts and testing them under the conditions of service for which they were intended to be used. Despite all the work done to date, however, no test for rubber-to-metal adhesion is complete until the actual part has been molded and bonded and tested under conditions that simulate actual service.

Several factors are involved in connection with the interpretation of a test for the determination of the quality of an actual part, and these cannot be extrapolated from a laboratory test on a standardized piece. Some of these factors are the composition, plasticity, thickness, and surface condition of the rubber stock; the type, thickness, and surface condition of the metal, and the proportion of metal to stock; the time and temperature of cure, method of molding or stock application; and the function of the bond, nature of stress on bond, etc.

The most obvious test and the one which was developed first by ASTM[4] workers was a simple tension test. A metal-rubber-metal sandwich-type specimen or button, such as shown in Figure 1 (*top*) is molded and pulled in tension on a tensile testing machine, and the results are recorded.[5] Using this well-defined ASTM test piece, test results exceeding 1,000 psi. can be obtained without too much difficulty; yet when direct tension pulls are made on pieces of somewhat different shape and area, 250 psi. may be considered satisfactory, 400 psi. may be considered very good, and 600 psi.

[4] American Society for Testing Materials, Philadelphia 3, Pa.
[5] ASTM D 429-58, Method A.

may be considered exceptional performance. Hence the futility of discussing numerical test results of this sort *except* as applied to identical assemblies. Furthermore, the fact that a particular system of stock plus bonding system plus metal preparation may give the best results on an ASTM test does not indicate that it will perform best in service. In all likelihood, the trouble is that we have oversimplified our testing methods.

To be most effective, a tension test should take into consideration the approximate thickness of the final part, method of molding or application of stock, time and temperature of cure to go along with shape of the part, etc. The author has never been able to correlate satisfactorily test results on a thin section, such as an ASTM tension button, with a thick section involving long, gradual cure and where the metal surface in contact with the cement receives an altogether different quantity of heat during the curing cycle. Without a doubt, the most satisfactory tension test is that performed on an actual production part under the conditions approximating the requirements for that part.

Strip testing, that is, measurement of the pull necessary to separate a rubber strip from a metal surface, has more recently become accepted and often preferred to the tension testing method. ASTM has developed a machine-pulled and recorded strip test,[6] also shown in Figure 1 (*bottom*). The actual pull results, the type of break, the bonding method used, and the metal and metal preparation used are all reported. This type of test is particularly useful in connection with applications involving rubber-lined or rubber-covered articles, such as chemical tanks, rubber covered rolls, accelerator pedals, industrial wheels, military tank track shoes, etc.

Many laboratories have for some years used a hand-cut-and-strip test. No numerical results are obtainable for pull with this test, but at the conclusion of the test the surface is examined and described. An estimate is made of the percentage area of metal showing, of the percentage area of cement showing, and the balance is considered stock failure. Such a hand-cut test is shown in Figure 2.

If this test is properly performed, and the bond is good, tearing of stock will result and is followed by further knife cuts back to the metal surface in order to get a fresh start. The same factors, that is, thickness of part, composition of stock, etc., will influence the results obtained with hand-cut-and-strip testing as they do with tension testing. It is easy to run laboratory hand-cut-and-strip tests with different thickness of rubber, and when thickness and cure rate of the production part are approximated in the laboratory test, the hand-cut-and-strip method comes closer probably to estimating the quality of a production part than the tension test method.

Numerical figures of the pounds pull required to strip rubber from metal in a bonded assembly should never be compared with those for another assembly if the metal or stock or thickness, or any other factor, has been changed. An inexperienced design engineer may be aware that one bonding system has given 250 pounds per inch on a strip test, but may not be aware that even with the same bonding system, metal preparation, thickness, etc., a value of no more than 100 pounds per inch may result if a softer rubber stock, suitable for some other application, but inadequate for this one, were used.

The testing of rubber-to-metal adhesion in shear is another type of testing not well understood. At the time of the development of the ASTM tension test, some reference was made to running tests in shear, using the same button-type test specimen. This modification of the ASTM tension method is rarely used, and when information on the effect of shear is required, the assembly should be tested functionally. Almost every tension test includes considerable shear stress as the rubber is stretched, and many parts are so designed that there is a combination of tension and shear stresses on the bond when tested or in use. These facts undoubtedly contribute to the inconsistencies in the results between those on test pieces and on actual parts.

Test methods involving both tension and shear stresses have been investigated in the past and also more recently. In the industrial laboratory where the original design work on the ASTM tension test was first conducted, considerable attention was directed to the shape of the ASTM tension test specimen and the shape of the metal parts to be used with it. Concave inserts, convex inserts, and inserts with a slight taper were tested. Also, an attempt was made to modify the test by changing the shape of the rubber between the two flat surfaces of the conventional ASTM tension test specimen. The rubber was molded in various shapes in an attempt to reduce the necking action which always took place at the metal surface during the test. All of these devices were tried and abandoned at the time because of the uncertainties and inconsistencies which resulted.

Fig. 3. New test specimen with conically shaped inserts for bonding to rubber

[6] ASTM D 429-58, Method B.

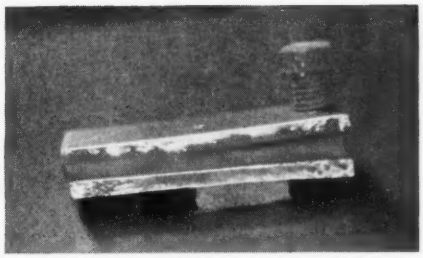


Fig. 4. Distention-type specimen showing bolt inserted through one metal plate for developing stress on the bond and rubber stock in a semi-dynamic test

More recently, a new proposal for testing in tension and shear was published[7] and has aroused some interest. As shown in Figure 3, conical inserts are used instead of the flat-surface metal parts of the ASTM tension test, and the former are used in such fashion that the points of the cones are relatively close together during the molding. These cones have much greater taper than the test pieces used in earlier unpublished work. The mechanics of the new test method are such that a very high unit tension is produced on the bond in the vicinity of the point of the cones while the tension at the base of the cone near the outside of the specimen is much lower.

The main virtue of this test is said to be that with a given rubber stock, bonding system, and metal surface, essentially only cement or metal failures are produced. The proponents of this test believe that they are no longer testing the strength of the rubber stock as is the case when a test procedure produces 100% rubber failure.

The progress in the development of this method is being watched with considerable interest. The complex relation between shear and tensile stress involved, together with the very critical effect on the bond at the two conical points which face each other, raises the question as to the value of this test. It is, however, a very interesting step in a direction not exhaustively covered heretofore and may lead to still more useful work in the testing of rubber-to-metal bonds.

Another test which has been of considerable interest and which is considered to be most useful by Dayton Chemical Products Laboratories is the semi-dynamic distention test illustrated in Figure 4. The idea of subjecting a bond to a certain type of stress while at the same time carrying out various types of aging is not new, and we have developed a simple means of applying such stress of substantial magnitude.

A sandwich-type specimen of metal-rubber-metal is prepared; a hole is drilled, or more than one hole is drilled through one metal part; the hole is tapped; one or more bolts are introduced into the hole or holes, thus forcing the two metal pieces apart and producing some definite degree of stress and elongation of the rubber. Thus a small test piece can be prepared which can be subjected to various aging conditions, such as, oven tests, atmospheric exposure tests, solvent or water immersion, while the rubber is under substantial stress. Any failure of the bond is accompanied by an exposure of a fresh line of bond, and the method is particularly useful when evaluating the effect of water or oil immersion upon a bonded area subjected to stress during such immersion. As in most other bond testing work, the results are highly empirical and arbitrary; nevertheless, the rubber technologist is able to secure guidance and draw tentative conclusions from a battery of such tests.

Current Bonding Methods

Today, rubber-to-metal bonding employs four basic systems. One-coat bonding agents,[8] for use with plain metal after only physical cleaning or chemical treatment of the surface, are the least expensive to apply. For more difficult jobs, two-coat systems[8] are generally employed. Brass plating[9] on other metal surfaces still is used for many bonded assemblies, and the use of a layer of ebonite[9] is still standard in the production of large rubber-covered rolls. It is estimated that, except for rubber-covered rolls, perhaps 15% of all bonded parts are made with brass plating of the metal surface, 55% with one-coat adhesion systems, and about 30% with two-coat adhesion systems.

One-coat systems are used almost universally for nitrile, neoprene, chlorosulfonated polyethylene, polyurethane, and silicone rubber stocks. Two-coat systems are used on the more difficult to bond natural and SBR stocks, as well as for butyl and fluorine-containing rubber compounds. One-coat systems are frequently used on these latter stocks as there are numerous exceptions to the general rule. Also, instances where the last coat is a tack layer for building purposes has not been included. Brass plate adhesion is slowly losing its popularity since it usually requires large-scale equipment and considerable and careful control. When functioning properly, it is an excellent means of bonding natural and SBR stocks, also sometimes butyl stocks to steel, and, in addition, adds some degree of corrosion resistance to the metal part. Brass tire valve stems are a special case, usually being bonded after nothing more than a chemical dip.

The several firms making bonding agents in this country offer a formidable array of materials with which the rubber products manufacturer can make his bonded parts. The current rate of progress in this field is very rapid, however, and it is best to check with the producers of bonding systems before proceeding with jobs involving difficult adhesion problems, new polymers, etc., since there may be new materials not listed in previous literature or available earlier for such jobs.

Adhesion Investigation Report

It is easy to state that adhesion techniques are em-

[7] G. W. Painter, *Rubber Age* (*N. Y.*), Nov., 1959, p. 262.

[8] American sources of one-coat and two-coat rubber-to-metal bonding systems include: Dayton Chemical Products Laboratories, Inc., "Thixon"; Marbon Chemical Division, Borg-Warner Corp., Washington, W. Va., "Ty-Ply"; Hughson Chemical Division, Lord Mfg. Co., Erie, Pa., "Chemlock"; Firestone Tire & Rubber Co., Akron, O., "Loxite"; and R. T. Vanderbilt Co., New York, N. Y., "Braze."

[9] For a complete discussion of brass plate and ebonite bonding see S. Buchan, "Rubber-To-Metal Bonding," Palmerton Publishing Co., New York (1959).

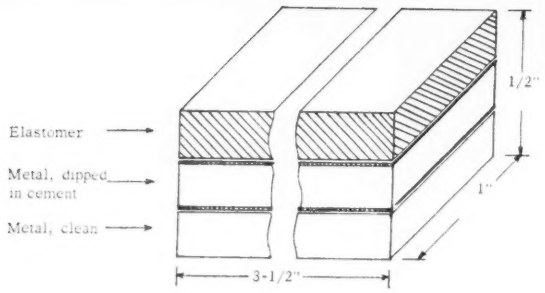


Fig. 5. Schematic diagram of hand-cut-and-strip test specimen used in adhesion investigation reported in the test results shown in this paper

pirical and tests arbitrary. For those who have not been involved in a careful program concerned with rubber-to-metal adhesion, a case history may prove to be of interest in illustrating how empirical tests can be of considerable value.

The problem investigated required the determination of the flow of several nitrile rubber bonding agents in transfer molds and the effects of prebaking the cement film to control the transfer of cement. In the course of the investigation, six different nitrile rubber stocks were used, six different adhesion systems were tested, and 84 separate tests were run.

The hand-cut-and-strip test method was used with the specimens prepared in a standard mold cavity measuring one- by 3½- by ½-inch thick. Two grit-blasted metal test bars measuring one- by 3- by 3/16-inch thick were first placed into the cavity; the top bar, exposed to the rubber stock, had been coated with bonding agent on both sides and allowed to dry before use. The bottom bar was uncemented. Figure 5 shows further the construction of the test specimen. The top section is ⅛-inch-thick rubber stock which has been molded in contact with the cemented bar below, with or without prebaking of the cement film. The bottom piece represents the steel bar to which no cement has been applied, but to which cement will be transferred from the middle bar according to the flow characteristics of the cement film under the molding conditions employed.

Observations were made after molding by examining the bottom bar for evidence of transfer of cement, as well as for staining. Then the rubber bonded to the top bar was cut-and-pulled to determine the degree of adhesion, using % rubber failure as the criterion; this was done by difference after estimating the % metal showing and the % cement showing. In this hand-cut-and-pull test, although the rubber is much thinner than shown in Figure 2, it still can be pulled away where adhesion is faulty, with stock tear occurring where adhesion is better than the strength of the stock. Frequent knife cuts back to the metal surface after tearing starts prevent a misleading appearance were a tear to start and bridge over an area which might have inferior adhesion and which might pull loose without tear if the knife cut to the metal were not made. The entire amount of rubber was so removed, using perhaps 15 or 20 knife cuts in the process. The areas of failure between metal and cement

TABLE 1. ADHESION INVESTIGATION, STOCK A WITH SIX CEMENTS, AIR DRYING *VS.* 60 MINUTES AT 300° F. CEMENT PREBAKE

	30 Min. Air		A. D. plus Prebake	
Cement	% R. F.	% Flow	% R. F.	% Flow
U	100	100	100	5
V	98	100	99	0
W	100	100	99	2
X	100	100	99	0
Y	100	100	60	0
Z	100	100	95	0

and between cement and stock are simply estimated and are accordingly subject to personal error. Consequently, it is not wise to emphasize a single test result or to rate differences in quality on the basis of single groups with small differentials. Larger groups of tests and repeated or consistent differentials, however, do indicate valid trends.

Also employed in this investigation was a prebake technique, whereby cement films were applied to the proper test bars and dried, then baked for varying lengths of time in an oven at 300° F., cooled, and the bars placed into the mold with the stock, molded as usual, and then the specimens tested for adhesion, and the lower bars examined for evidence of transfer of cement.

Most of the rubber stocks used in the work were submitted by customers, and knowledge of the formulations was quite limited. It was known, however, that Stock A was a normal nitrile rubber compound of medium hardness and good general physical properties. Stock B was a regular nitrile rubber stock plasticized with Picco 25[10] and TP-90B;[11] Stock C was a Hycar 1041[12] compound, cured with Sulfasan R[13] and Thiurad,[13] plasticized with DBP (dibutyl phthalate) and Piccolyte S-10,[14] with no free sulfur; Stock D was a Hycar 1022 (medium high nitrile) compound, plasticized with Plasticizer SC[15] and Picco 25 and meeting R-900 specifications.[16] Stock E was a low-sulfur nitrile rubber compound containing Plasticizer SC; and Stock F was a Hycar 1072[17] compound. The cements used were coded, U, V, W, X, Y, and Z, some of which were regular commercial cements. The assemblies were all cured for 25 minutes at 320° F.

Table 1 gives some preliminary data on tests made with all six cements for Stock A only, but using two different cement application techniques. In the first two

[10] Coumarone-indene resin, Pennsylvania Industrial Chemical Corp.; Harwick Standard Chemical Co., Akron, O., selling agent.
[11] High molecular weight polyether, Thiokol Chemical Corp., Trenton, N. J.
[12] High nitrile content rubber, B. F. Goodrich Chemical Co., Cleveland, O.
[13] Monsanto Chemical Co., rubber chemicals department, Akron.
[14] Beta-pinene polymer, Pennsylvania Industrical Chemical Co., Harwick Standard Chemical Co., selling agent.
[15] Harwick Standard Chemical Co.
[16] See "Hycar Technical Manual," p. 167, 1951 Edition, B. F. Goodrich Chemical Co.
[17] Carboxylic nitrile rubber, B. F. Goodrich Chemical Co.

TABLE 2. ADHESION INVESTIGATION, SIX NBR STOCKS, SIX CEMENTS, CEMENT FILMS PREBAKED 30 MINUTES AT 300° F.

	Stock A			Stock B			Stock C		
Cements	% R. F.	% Flow	% Stain	% R. F.	% Flow	% Stain	% R. F.	% Flow	% Stain
U	100	10	0	95	10	40	99	10	0
V	100	0	0	40	0	30	99	0	0
W	100	0	0	95	0	30	90	5	0
X	100	0	0	100	2	5	100	0	0
Y	97	0	0	100	2	0	40	1	0
Z	85	0	0	80	5	60	80	1	0
	Stock D			Stock E			Stock F		
Cements	% R. F.	% Flow	% Stain	% R. F.	% Flow	% Stain	% R. F.	% Flow	% Stain
U	98	10	20	95	10	30	30	20	70
V	40	5	80	60	10	75	70	2	70
W	97	1	20	95	0	30	60	0	60
X	98	2	5	98	5	30	100	5	5
Y	100	5	50	20	5	80	100	5	50
Z	98	10	60	70	2	70	80	10	50

columns, % rubber failure and % flow of cement are recorded for cement film dried only in air. Virtually perfect adhesion of rubber to the cemented test bar was obtained in all cases; while on the bottom side of this same cemented test bar there was complete transfer of cement to the uncemented test bar below, indicating in this latter case the possibility of mold dirtying and movement of cement during a transfer molding operation, or in the case of compression molding, considerable movement of the stock during the molding operation.

In the second two columns of Table 1 data are recorded for the test where the cement film was baked for 60 minutes at 300° F. after air drying. Flow of the cement film dropped to from 0 to 5%; however, adhesion with Z dropped 5% and with Y 40%. Three other cements showed a slight loss of adhesion.

As a result of the preliminary work, a series of tests was run with all six stocks and six cements using air drying plus a 30-minute prebake at 300° F., and the data are reported in Table 2. In this series of tests and in following tests, not only was the degree of flow checked, but also the area of stain on the bottom test bar. Since the entire area of the bottom bar was exposed to possible transfer or flow of cement from the dipped bar above, % flow means the % area of the bottom bar apparently coated with cement at the end of the test; this cement flowed from the bar above. At this stage we started noticing not only flow of cement, but in some cases areas on the bottom bar where there was stain only, presumably a partial or incipient transfer of cement. Without fully understanding the mechanics of this staining action we recorded thereafter estimates of the areas showing this stain.

In Table 2, with Stock A, adhesion was excellent for cements U through X, but somewhat lower with Y and Z; a very small amount of flow resulted with U, and no flow or stain in other cases. Stock B is difficult to bond with most cements although X and Y did a good job; stain and flow were higher in most cases with this stock, indicating some strange sort of effect during molding, possibly a small degree of vaporization of plasticizer or plasticizer impurities. Stock C bonded readily with three cements, but the bond with Y and Z was not so good; flow and stain were low. Stock D gave good adhesion with all cements except V; flow is low, but staining is pronounced in all cases. Stock E bonded well with three cements, poorly with three others; again flow was slight, but stain quite pronounced. Stock F bonded well with cements X and Y, not so well with the others; some high flow is recorded; staining is high except for X.

It is evident from the results reported in Table 2 that cements and stocks must be matched carefully in order to obtain maximum adhesion when cement films are prebaked and that flow of the cement film during vulcanization is influenced very substantially by the stock. Another conclusion, which will be reinforced later, is that cement Y cannot take a very long prebake. Although some of the results with Y appeared satisfactory, we may suspect that some sort of plasticizer volatilization may have reactivated a partially set up film.

The results recorded in Table 3 are for a similar set of experiments, but in which the prebake time was increased from 30 to 60 minutes at 300° F. Stock A bonded well with all the cements except Y and Z; stain and flow were uniformly low or nil. The adhesion to Stock B is off with most of the cements, as was the case with the 30-minute prebake; flow and stain are generally low, except for the high stain value with cement Y. Stock C bonds well with cements U and X, not so well with the other cements; flow and stain are low. Stock D gave poor adhesion with cement V, fair with Y and Z, good with U, W, and X; stain and flow remain low. Stock E showed no adhesion with cement Y, good adhesion with X, fair with U, V, and W, not so good with Z; flow and stain were generally low. Stock F bonded well with X, fairly good with U, poorly with W and Z, and not at all with V and Y; flow and stain range from 0 to low.

In all of these tests it must be recognized that any individual test result will probably not be reproducible,

TABLE 3. ADHESION INVESTIGATION, SIX NBR STOCKS, SIX CEMENTS, CEMENT FILM PREBAKED 60 MINUTES AT 300° F.

	Stock A			Stock B			Stock C		
Cements	% R. F.	% Flow	% Stain	% R. F.	% Flow	% Stain	% R. F.	% Flow	% Stain
U	100	10	0	90	10	0	100	5	0
V	100	0	0	90	2	0	90	5	2
W	100	0	0	95	0	3	80	2	0
X	100	0	0	99	0	0	99	0	0
Y	97	0	1	50	0	60	0	0	0
Z	85	0	0	70	1	0	80	5	0

	Stock D			Stock E			Stock F		
Cements	% R. F.	% Flow	% Stain	% R. F.	% Flow	% Stain	% R. F.	% Flow	% Stain
U	99	5	2	95	5	0	95	5	10
V	40	0	0	80	1	0	2	1	0
W	99	2	0	90	2	0	60	1	0
X	100	0	0	99	0	5	99	0	0
Y	90	0	0	0	0	0	0	1	0
Z	80	2	0	70	0	0	50	0	0

TABLE 4. RUBBER FAILURES FOR SIX NBR STOCKS, SIX CEMENTS

	Cement Film Prebake, 30 Minutes at 300° F.						Cement Film Prebake, 60 Minutes at 300° F.					
	Cements						Cements					
Stocks	U	V	W	X	Y	Z	U	V	W	X	Y	Z
A	100	100	100	100	97	85	100	100	100	100	97	85
B	95	40	95	100	100	80	90	90	95	99	50	70
C	99	99	90	100	40	80	100	90	80	99	0	80
D	98	40	97	98	100	98	99	40	99	100	90	80
E	95	60	95	98	20	70	95	80	90	99	0	70
F	30	70	60	100	100	80	95	2	60	99	0	50
Approximate order of quality	3	6	2	1	5	4	2	5	3	1	6	4

TABLE 5. % FLOW AND % STAIN FOR SIX NBR STOCKS, SIX CEMENTS

Cement Film Prebake, 30 Minutes at 300° F.

	Cements											
	U		V		W		X		Y		Z	
Stocks	F	S	F	S	F	S	F	S	F	S	F	S
A	10	0	0	0	0	0	0	0	0	0	0	0
B	10	40	0	30	0	30	2	5	2	0	5	60
C	10	0	0	0	5	0	0	0	1	0	1	0
D	10	20	5	80	1	20	2	5	5	50	10	60
E	10	30	10	75	0	30	5	30	5	80	2	70
F	20	70	2	70	0	60	2	5	5	50	10	50
Approximate order of quality	4		6		2		1		3		5	

Cement Film Prebake, 60 Minutes at 300° F.

	Cements											
	U		V		W		X		Y		Z	
Stocks	F	S	F	S	F	S	F	S	F	S	F	S
A	10	0	0	0	0	0	0	0	0	1	0	0
B	10	0	2	0	0	3	0	0	0	60	1	0
C	5	0	5	2	2	0	0	0	0	0	5	0
D	5	2	0	0	2	0	0	0	0	0	2	0
E	5	0	1	0	2	0	0	5	0	0	0	0
F	5	10	1	0	1	0	0	0	1	0	0	0
Approximate order of quality	6		5		4		1		2		3	

and in fact, where no adhesion is obtained with one specimen with cement prebaking, another test of a similar specimen may register fairly good adhesion. An examination of all of the results indicates an unmistakable trend; however, certain cements do not provide as good adhesion when prebaked; others are not affected. The study did show that flow was virtually eliminated in most cases and reduced in all cases with the use of cement prebaked for either 30 or 60 minutes.

In Table 4, values for rubber failure for the six stocks and the six cements have been tabulated for the 30-minute cement prebake, and a definite trend seems to be established as to the bonding properties of the stocks and cements. Stock A is easily bonded after a 30-minute cement prebake with all of the cements tested. Stocks E and F can be bonded with certain cements and not with others and generally present other problems. Results with the other stocks range from good to poor for the various cements. It is to be noted that the right fit of cement and stock produces a good bond.

Table 4 also presents comparisons for rubber failure for cements prebaked for 60 minutes instead of 30. Again, Stock A bonded well with all of the cements while the other stocks ranged from good to poor, depending on the cement used. The approximate order of quality of each cement with the six stocks is estimated, and it will be noted that cement X rates as best in its ability to bond a variety of stocks as compared with other cements which are more specific in their choice of stocks with which they will bond well.

Table 5 tabulates the data on flow and stain for all the stocks and cements for the 30-minute cement prebake. Cement X showed up best for all of the stocks used. In examining the data by stocks, A and C seemed to have the lowest flow and stain with all of the cements tested; while the other stocks gave high value with some of the cements.

Table 5 also tabulates flow and stain data for all the stocks and cement for the 60-minute cement prebake. Cements X, Y, and Z show the least flow and stain for this prebake time. We must remember, however, that these cements have set up so much that adhesion was impaired with some of the stocks. Examined by stocks, it appears that there is little evidence of pronounced differences in flow and stain at this cement prebake time. Cement X, however, again appears to be the best of the six cements tested.

Summary and Conclusions

An examination of the results obtained with various standard and laboratory methods of metal surface preparation for rubber-to-metal bonding substantiates the conclusion that cleanliness of metal surface is the most important factor in metal preparation, and also this fact suggests possible improved production methods.

Oversimplification of test methods for rubber-to-metal adhesion and discrepancies between production and laboratory tests can sometimes produce real pitfalls in attempts to rate the quality of adhesion.

In considering current bonding methods, the trend continues toward the use of one-coat chemical adhesion systems wherever possible, with one- and two-coat commercial systems available for quality adhesion with all current elastomers.

Certain overall conclusions may be offered as a result of the specific adhesion investigation reported in this paper. Cement prebaking as a means of controlling cement film flow and mold dirtying is definitely advantageous with certain of the cements tested. Stock formulation is another important factor, both with regard to adhesion and the effect of stock flow on movement of the cement film, mold dirtying, etc. It is suggested that where stain and flow are affected by a stock physically separated from the cement film during molding, some sort of vapor action may be involved. Finally, the study demonstrates that good adhesion requires matching of cement and stock in each specific instance.

Acknowledgment

The author is indebted to R. L. Riege and L. E. Calkins for the tests and data used, to P. J. Larsen for the illustration of adhesion test specimen with the conical inserts, and to A. H. Flower and R. E. Antheil for private communications regarding early ASTM experimental work on testing rubber-to-metal bonds.

■

Watch Facts and Figures

Two deciding factors in evaluating potential success or failure of a rubber manufacturing company management are: (1) worry about facts and (2) give attention to figures, according to Commercial Discount Corp., Chicago, Ill., a major capital loan lender to the industry.

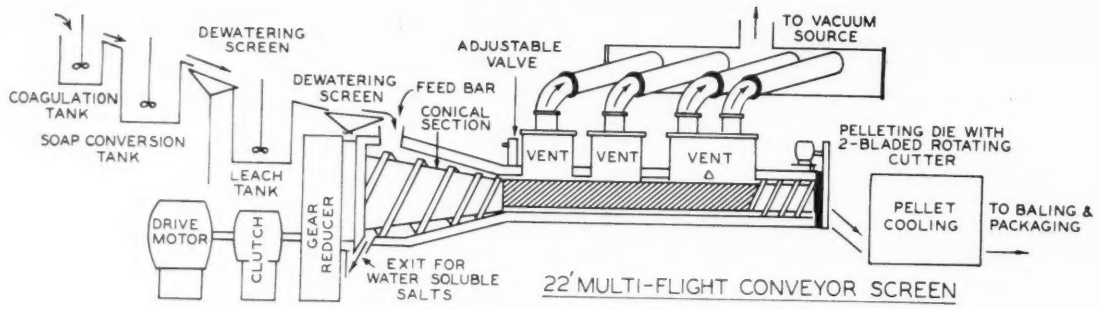
Based on results of experience in lending close to a billion dollars, Sidney Feuchtwanger, president, said, "You can predict a company's future from these two qualities alone. We have learned that no matter what tremendous assets a rubber corporation has at the moment, the business is an unsound risk if the management does not worry about facts or about numbers."

It was stated that a factually minded management makes an extensive market study on a new product and determines production and sales costs and then determines company action by such facts. A primary reason for failure of businesses has consistently been found to be optimistic speculation on the part of managers who refused to worry about projected sales, operating problems, capital requirements, et cetera.

With regard to attention to figures, a case was quoted where a good-sized manufacturing company was recently found to have been losing money on one of its products every year for fifteen years, simply because the president "hated figures" and failed to keep tabs on separate products.

Companies continue unprofitable lines, or continue to serve customers on which they lose money, only because nobody has the disposition to worry about figures where there are more glamorous things to do.

Commercial Discount made its new five-year capital loans only to companies which possess these two qualities.



New Extrusion Dryer for Low-Ash SBR In Operation at Institute, W. Va., Plant

By D. L. MATTHEWS and H. E. PHELPS
Goodrich-Gulf Chemicals, Inc., Cleveland, O.

AT THE Institute, W. Va., plant of Goodrich-Gulf Chemicals, Inc., the first production-scale extrusion dryer is now being used in the manufacture of SBR polymers of low ash and uniformly low moisture content for use in wire and cable insulations, shoe soles, automotive rubber products, floor tile, and tire stocks by the rubber industry.

This new 50-ton, 40-foot-long extrusion dryer unit, with a design capacity of four tons of dried rubber per hour, was built for Goodrich-Gulf by National Rubber Machinery Co., Akron, O., and the installed cost of the unit and its auxiliaries was $750,000. This SBR producer has been working with National Rubber Machinery for a number of years on the development of an improved extrusion method for drying synthetic rubber, and the new unit in operation at Institute is the result of these combined efforts. Extrusion techniques tried previously by the synthetic rubber industry were found wanting because of cost, low production output, and the problem of corrosion of some of the metal surfaces of the equipment used by small amounts of certain chemicals found in the rubber at certain stages of the drying process.

Several years ago Goodrich-Gulf market analysts took a hard look at SBR potentials and recommended that some way be found to produce electrical-grade polymers for an estimated initial market of six million pounds per year and an additional market of twelve million pounds a year of high-grade extrusions for shoe soling and automotive extrusions. The problem was to find a way to produce these polymers at a cost consistent with current market prices.

The development and use of this new extrusion-type dryer represents a crack in a major bottleneck in the production of synthetic rubber to the industry as a whole and means expanded markets for Goodrich-Gulf and a lead on its competitors in the production of high-grade specialty SBR polymers.

Goodrich-Gulf does not yet regard extrusion drying as a replacement for conventional air drying, but until the answer to that question is known, the company now has an efficient means of producing high-quality, low-ash SBR polymers for specific markets and possibly at a lower cost than by previously used methods.

SBR Drying Problems

To SBR producers, drying operations have been the source of concern for many years. Conventional hot-air dryers are relatively slow, require extensive maintenance, and although they deliver rubber with the low moisture content desired, the ash content is too high, unless a special finishing operation is used, for certain rubber product applications.

Drying synthetic rubber in a three-pass, hot-air dryer is accomplished on perforated metal belts, and these perforations often become plugged with rubber, reducing air circulation and the output of properly dried crumb. In addition, residual rubber of one type remaining in the dryer after a run may contaminate rubber of another type in the next run, unless the dryer is thoroughly cleaned between runs of different types of rubber. Cleaning is a time-consuming, costly, manual job. A crew with special equipment takes a week to clean a single unit.

Another difficulty with conventionally dried rubber is that it can sometimes meet moisture specifications and still contain concentrated areas of moisture that are above the specifications. These "wet spots" slow down pigment absorption by the rubber during mixing and compounding, and they also reduce the quality of the finished products.

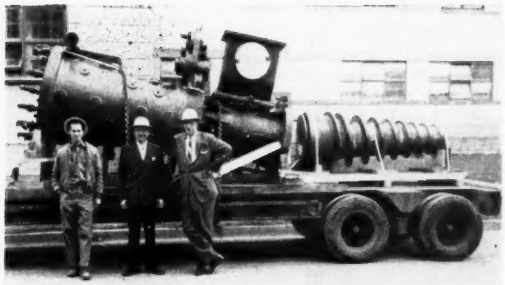


Fig. 2. Conical screw and housing section of extruder dryer arriving at Goodrich-Gulf plant. Taking part are *(left to right)* Robert Ralph, Girdler Co., Bert Holz, National Rubber Machinery Co., and H. E. Phelps (co-author of this article)

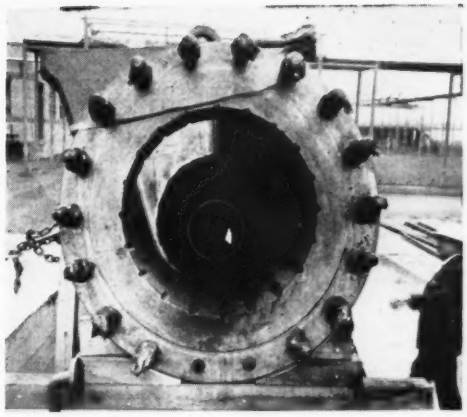


Fig. 3. Interior of conical screw housing before installation. About 80% of the total moisture content of the crumb is squeezed out in this section of the dryer

Extrusion Dryer Details

The new extrusion dryer now in operation at Institute consists of a four-foot conical screw section, where 80% of the water is removed from the rubber crumb; a 22-foot long, 12-inch diameter, multi-flight screw, which moves the crumb through a series of three vacuum chambers where the remaining moisture is flashed off; and the round pelleting die and rotating, double-bladed knife, which slices off the strands of dry rubber emerging from the die.

An 800-hp. induction motor, coupled through a clutch to a gear reducer, powers the conical screw. This conical screw tapers from a head diameter of 36 inches to a base diameter of 12 inches in its four-foot length.

At the top of the housing for the conical screw is the feed box. Wet crumb rubber from the leaching tanks passes over a vibratory screen, through the feed box opening, and into the conical screw section. The wet rubber is pushed down the flights of this screw to an adjustable sliding cylinder valve, and as the rubber is compressed at this valve, water is squeezed out of the rubber and flows through the opening in the bottom of the conical section, carrying with it most of the water soluble salts. Residence time here is two minutes.

At the junction of the conical screw and the main 22-foot-long conveyor screw is the adjustable cylinder valve which sheets out the rubber to thicknesses between 0.015- and 0.125-inch, depending on the type of rubber being dried, and presents an ideal surface area for the removal of more water in the first vacuum vent section. The rubber is conveyed through all three vacuum chambers, where a vacuum of 27 mm. of mercury or below is maintained, by the main conveyor screw, and when the rubber leaves the last chamber, its moisture content is at or below the specified 0.5%.

As mentioned above, when the rubber leaves the last vacuum chamber, it is forced by the conveying screw through a round pelleting die, and strands of dry rubber are sliced off with a rotating knife; then the material is cooled, baled, and made ready for shipment.

From the entry of the wet crumb rubber into the feed box until it passes through the pelleting die takes only from five to ten minutes, as compared with the two-hour cycle for the conventional hot-air dryer.

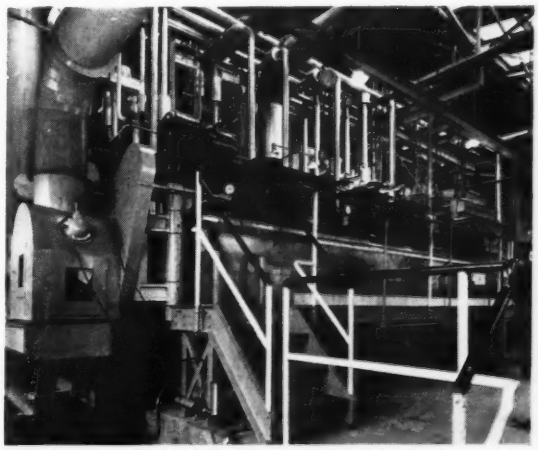


Fig. 4. Overall view of this extruder dryer

Temperature control throughout the process is essential to product quality and smooth functioning of the machine. The conical screw section is cored to permit heating and cooling, and, in addition, the machine has several jacketed sections so that temperatures may be varied at different points in the process. Temperatures in the feed section are generally held at 140° F., in the conical screw section between 150 and 200° F., in the vacuum chambers at 250° F., and in the end section between 80 and 100° F.

In addition to machine temperature controls, a complex system of temperature and pressure pick-ups has been placed at strategic points through the unit to monitor rubber temperatures as an indication of dryness, and to determine factors of machine safety. For example, in the conical screw section and immediately adjacent to the adjustable sliding cylinder valve, a thermocouple measures the temperature of the rubber before it passes through the valve to determine how much heat has been generated in the rubber by the conical screw

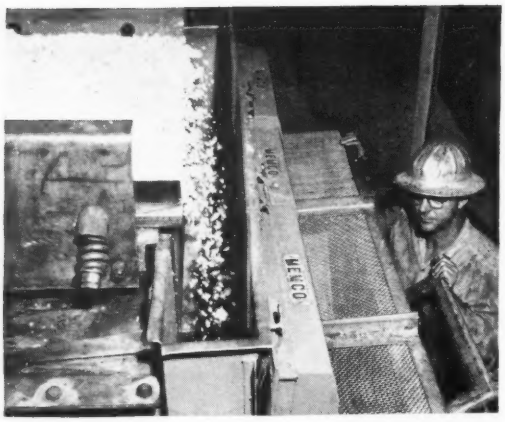


Fig. 5. Wet SBR crumb dropping from vibratory screen into the feed box section of the dryer

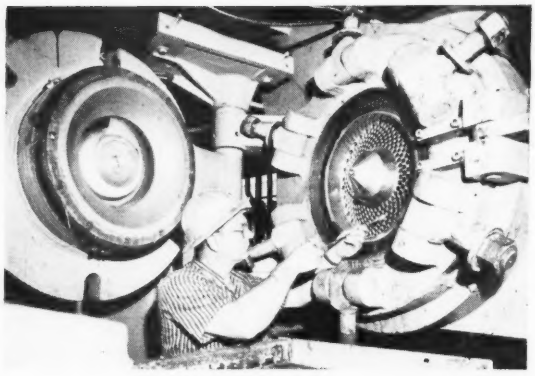


Fig. 6. Rubber leaving extruder dryer passes through pelleting die *(right)*, which is hinged for easy cleaning. At left is the end of the 22-inch screw

compressing it for the removal of water. Thermocouples are used also to measure the temperature of the rubber after it has passed this valve and in each of the vacuum chambers in order to get an indication of the dryness of the rubber at these several points. The temperature of the rubber is again measured after it leaves the last vacuum chamber and at the die plate, and the differential between these two points indicates how much the rubber is worked during final extrusion.

Pressure pick-ups are located in the conical screw section and at the die plate, the first as a safety device to prevent the machine from running empty, and the second as another measure of the amount of work being done on the rubber in the final extrusion section.

All motor, transmission, rpm., feed, and temperature controls, vacuum pressures, and safety devices are linked to a central control panel which monitors the entire operation. Operating conditions can be altered even while a production run is in process, and these changes take effect immediately.

The entire extrusion unit is constructed of special alloys capable of resisting the corrosive action of any residual chemicals in the rubber.

A special building was constructed at the Institute plant to house the new extrusion dryer. Extra-heavy foundations were poured to accommodate the massive weight of the machine on a steady platform and to insure that there would be no variation in the tolerances between the screw and the cylinder.

One end of the building was made removable to facilitate the movement of the one-piece, 22-foot screw section in and out of its housing. Because of the minute tolerances required between the screw and the cylinder, a specially designed trolley was built and mounted on tracks for this purpose.

The Product

Production runs have been made primarily on hot, fatty-acid soap emulsified, glue-acid coagulated SBR electrical grades 1016 and 1019. The unit is also enjoying equal success in producing low Mooney rubbers.

Rubber processed in the extrusion dryer is free of contamination from residues of previous runs since the unit effectively cleans itself in operation. Also, there are no "wet spots" in extrusion dried SBR, and the consumer is therefore assured of color uniformity in his raw material and ease of incorporation of pigments.

There are indications that SBR run through the extrusion dryer will have Mooney viscosities 4 to 6 points lower than the same type would have if processed through a conventional hot-air dryer, which should mean less power consumption during compounding and mixing of extrusion dried rubber for the rubber products manufacturer. If SBR of Mooney viscosity equal to that processed in the hot-air dryer is desired, the Mooney viscosity of the contained polymer in the latex can be increased somewhat.

Although the extrusion dryer at Institute is a production unit, Goodrich-Gulf still describes its new equipment as being "in an advanced stage of development." The last remaining test is extensive customer use of extrusion dried SBR.

Fig. 7. Main control panel monitors entire extruder dryer operation including temperature levels, automatic shut-off devices, pressure pickups, and motors

Modulus of Elasticity of Ebonite Materials

I. Tensile Measurements on SBR Vulcanizates

By W. J. DERMODY

Carl F. Norberg Research Laboratories, The Electric Storage Battery Co., Yardley, Pa.

DURING the 20-year period between 1940 and 1960 styrene-butadiene copolymer rubber (SBR) has achieved a position of paramount importance among industrial elastomers, not only in the field of truly elastomeric soft rubber products for which the polymer was originally developed, but also in the production of more rigid hard rubber vulcanizates. As knowledge of the behavior of the polymer during processing and of the properties available after vulcanization has increased, the application of this type of material has multiplied to a host of end-use applications in which SBR has wholly or partially replaced both natural rubber and the reclaimed rubbers derived from it.

The critical nature of the strategic shortage of rubber during World War II and the years immediately following it provided the impetus for a number of crash programs of research into the vulcanization and properties of SBR and other elastomers. These were sponsored by the Federal Government and conducted under the auspices of the United States Rubber Reserve Co., Reconstruction Finance Corp., and successor agencies. A very considerable amount of experimental work was also undertaken by the rubber consumers at this same time, but very little of this has been recorded in the literature. Also, after the war had ended the government-sponsored investigations in the field of hard rubber were terminated, in some cases so abruptly that only inconclusive or fragmentary data were available.

Most of the information on SBR ebonites which appeared significant or was complete enough to merit consideration was reviewed by Malm and Peters[1] and included by them in the chapter on "Synthetic Hard Rubber" in the book entitled "Synthetic Rubber," which was prepared under the auspices of the Division of Rubber Chemistry of the American Chemical Society in 1954. Much of the work reported in this and subsequent publications was concerned with recipes for specific end-use applications or compounding studies in which the characteristics of the polymer were subordinated to and modified by the addition of other ingredients such as oils and fillers.[2, 3, 4] There is little to be found on the characteristics of pure synthetic rubber ebonites other

[1] F. S. Malm and H. Peters, in "Synthetic Rubber," by G. S. Whitby *et al.*, pp. 573-591, John S. Wiley & Sons, Inc., New York (1954).
[2] W. M. Gall, *Rubber Age, (N.Y.)*, 65, 4, 417 (1949).
[3] R. E. Morris, P. Mitton, I. Seegman, T. A. Werkinthin, *Ibid.*, 54, 129 (1943).
[4] F. S. Rostler, India RUBBER WORLD, 117, 492 (1948).

The Author

W. J. Dermody

William J. Dermody, group leader in organic chemistry, Carl F. Norberg Research Center, Electric Storage Battery Co., received his B.A. from Alfred University in 1939.

Mr. Dermody worked for American Hard Rubber Co. from 1940 until 1944, when he joined Joseph Stokes Rubber Co. He remained with this organization when it became the Stokes Molded Products Division of Electric Storage Battery Co. in 1946. He was chief chemist until 1951 and then supervisor of chemical engineering until 1956. He was transferred to the Carl F. Norberg Research Center in 1956 and has held his present position since then.

Mr. Dermody is a member of the American Society for Testing Materials and is present chairman of subcommittee 23 on hard rubber of Committee D-11. He has also acted as chairman and secretary of subcommittees of Committee D-20. He is, moreover, a member of the American Chemical Society and its Division of Rubber Chemistry. He served on the Hard Rubber Industry Technical Consulting Committee, United States Department of Commerce, from 1946 to 1951. He is active in many civic and fraternal organizations in Mercer County, N. J., where he resides.

Tensile Measurements on SBR Ebonite Vulcanizates

Calculation of available unsaturation rather than reliance on rule-of-thumb is suggested as the route to realization of the full potential of ebonites prepared from SBR 1000 polymer. This suggestion is based on the results of the analysis of stress-strain characteristics and breaking stress and strain values for ebonite mixtures containing from 15 to 33% sulfur.

The SBR 1000 ebonite mixtures used in this work were accelerated with butyraldehyde amine and cured at 165° C. (329° F.) for times sufficient to provide a spread of properties for each mixture covering the entire range from minimum vulcanization to the point at which there was no evidence of further reaction with increase in time. Complete vulcanization appeared to be achieved between 22 and 28% recipe sulfur (29.3 to 40.5 parts sulfur on 100 rubber) based on an examination of the tensile values for the experimental compounds, with 22% producing essentially the same effect on vulcanizate properties as 28% sulfur.

Vulcanizable unsaturation in SBR 1000 was calculated on the basis of the 1,4-butadiene addition in the polymer, and agreement of the calculated value of 24.7 to 26.4% sulfur in the recipe (32.8 to 35.9 parts sulfur on 100 rubber) with the experimental findings from the tensile measurements was found.

The sulfur content of the majority of commercial SBR ebonite recipes probably lies in the range of 35 to 50 parts per 100 rubber, and, therefore, these recipes contain more sulfur than is necessary for full vulcanization.

than the work of Winspear, Herrman, Malm, and Kemp[5] in the high sulfur range and that of Cheyney and Robinson[6] in the ebonite and semi-ebonite range. Even Scott's[7] excellent treatise on ebonite relies almost entirely on work done on German Buna S and the original Buna 85 and 115 polybutadiene polymers in the area around 1939 and shortly thereafter.

In view of the paucity, and sometimes contradictory nature, of the available information, it appeared desirable to undertake work which would provide a reliable guide to the mechanical properties available from SBR hard rubber vulcanizates and which would be useful in estimating their design capabilities in terms of the probable behavior of finished products. In view of the large amounts of such materials used in the manufacture of battery containers and other parts for lead-acid batteries, it seemed appropriate that we should undertake this work.

Experimental Details

The polymer used was taken from a single lot of commercial SBR 1000 which was used, as received, without any extraction or other treatment to remove fatty acid, soap, stabilizer, or any of the other non-elastomeric materials customarily present in the commercial product.

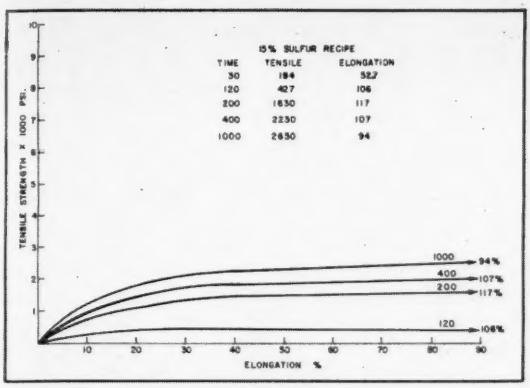
Accelerator Masterbatch

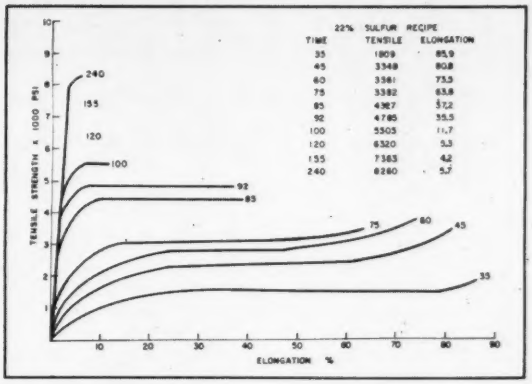
The rubber was weighed out into a series of small batches, to each of which was added butyraldehyde-aniline-condensation-product accelerator in the proportion of four parts by weight of accelerator to 100 parts of rubber. Each of these small batches was mixed separately and thoroughly blended by passing the mixed batch end for end through tight rolls on a conventional two-roll rubber mixing mill.

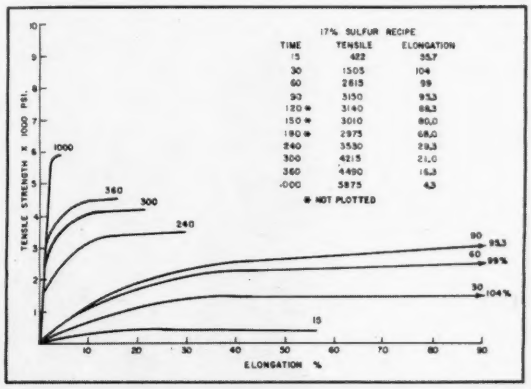
The series of accelerator masterbatches so produced was then cross-blended by serially numbering the batches and then blending each odd-numbered batch with the even-numbered batch immediately above it in the series. The blended masterbatches were then arranged in random sequence, and each was divided and numbered as before, so that one half of each blended masterbatch carried an odd number, the other half an even number. The odd-numbered batches were arranged in random pairs, and each pair blended together; then the same procedure was followed for the even-numbered batches. The reblended masterbatches were again laid out in random sequence, cut in half, numbered, and again blended until five complete cycles of reblending had been completed, following the same pattern on each. Any lack of uniformity in the raw materials or weighing error was minimized by having been halved six times and spread in random fashion among the remaining masterbatches.

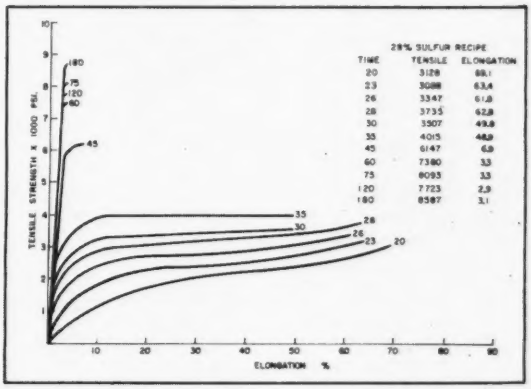
The polymer content of the mixed masterbatch was estimated by sheeting out representative samples of the cross-blended masterbatch and determining extract and ash in accordance with ASTM Method D 297-55T.[8] The extract was determined by the method given for acetone extract except that 200 milliliters of ethanol-toluol azetrope was used as the extraction solvent, and the weight of the residue after extraction was determined by drying *in vacuo* at 80° C. to constant weight. The ash was determined by ignition in a muffle furnace in accordance with the rapid method given in the procedure. The loss in weight after extraction and drying was 9.06%; the average ash was 0.50%, thus giving a

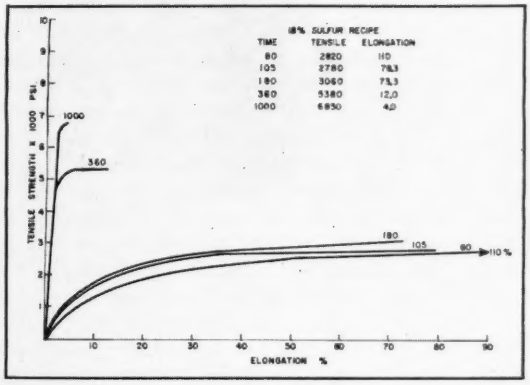
[5] *Ind. Eng. Chem.*, 38, 687 (1946).
[6] *Ibid.*, 35, 976 (1943).
[7] J. R. Scott, "Ebonite," Maclaren House, London, England (1958); also *Rubber Chem. Tech.*, 17, 719 (1949).
[8] "ASTM Standards," Part 9, American Society for Testing Materials, Philadelphia 3, Pa.

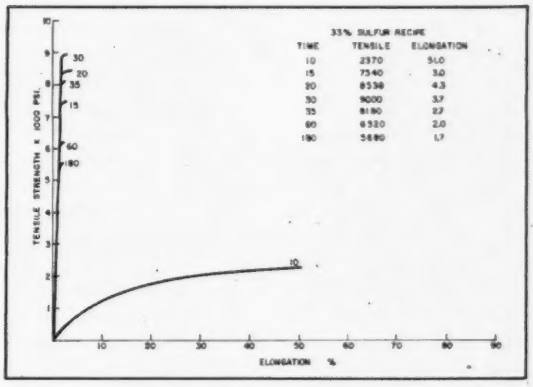












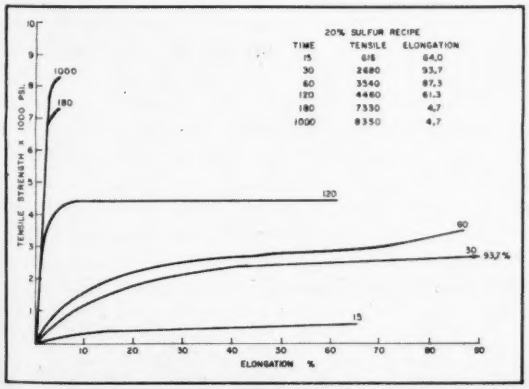


Fig. 1. Stress and strain at break, and stress-strain values of entire range of test for accelerated SBR 1000 recipes containing from 15 to 33% sulfur.

TABLE 1. SBR 1000 RECIPE SULFUR PROPORTIONS

% Sulfur in Recipe[1] as Compounded	Parts Sulfur[2] per 100 Rubber	Parts Sulfur[3] per 100 Polymer
15	18.4	19.5
17	21.3	22.7
18	22.8	24.3
20	26.0	27.6
22	29.3	31.2
28	40.5	43.0
33	51.2	54.5

[1] Recipes compounded by taking 15 through 33 parts sulfur, as indicated, and adding accelerator masterbatch in amounts sufficient to total 100 parts of completed compound.

[2] Sulfur on 100 rubber calculated using rubber content of masterbatch of 96.15% in the following ratio:

$$\frac{\text{Parts mb.} \times 0.9615}{100} = \frac{\text{Parts S}}{X}$$

[3] Sulfur on 100 polymer calculated using polymer content of masterbatch of 90.44% and the following ratio:

$$\frac{\text{Parts mb.} \times 0.9044}{100} = \frac{\text{Parts S}}{X}$$

total estimated non-polymer of 9.56%. On this basis, the polymer by difference was estimated as 90.44% in the masterbatch. Since the rubber content of the masterbatch may be calculated as 100/104 x 100, or 96.15%, and the polymer content of the masterbatch has been determined to be 90.44%, the polymer content of the SBR-1000, as received, may be calculated to be 90.44/96.15 x 100, or 94.06%.

Ebonite Recipes—Compounding and Testing

A series of ebonite recipes was prepared by mixing sulfur (15 through 33 parts) into portions of the accelerator masterbatch in amounts sufficient to total 100 parts completed compound in all cases, on a two-roll rubber mixing mill. The mixtures so prepared were identified by the number expressing the percentage of sulfur in the resulting mixture. In each case four to six batches of a recipe were mixed separately and then blended and reblended in the same manner as followed for the accelerator masterbatch.

Batches representative of the various sulfur proportions used were analyzed by a method previously disclosed[9] for total sulfur content, both in the vulcanized and unvulcanized conditions (data not shown), and agreement with recipe proportions within 0.1% of the predetermined amount was found.

The two recipes containing more than 22% sulfur showed evidence of melting and exudation of sulfur on the surface during vulcanization. Random samples taken from the surface layer of specimens from each of these two batches were found by analysis to have sulfur contents from +5% to —1% of the prescribed values. This segregation phenomenon, however, was not found in the center thickness of the slabs from which the tensile specimens were taken.

Table 1 gives the % sulfur in the recipes as compounded, the parts sulfur on 100 rubber, and the parts sulfur on 100 of polymer in these recipes as calculated from the rubber and polymer contents of the accelerator masterbatch. These amounts of sulfur cover the range from semi-ebonites to compounds containing sulfur in large excess of the proper combining proportions, as will be shown later.

The various recipes were sheeted into slabs slightly over ¼-inch in thickness and vulcanized in flash-type compression molds ¼-inch in thickness. All of the specimens were vulcanized at a temperature of 165° C. (329° F.), and the time of vulcanization was varied by increments for each recipe to give a spread of specimen properties covering the entire range from minimum vulcanization to the point at which there was no evidence of further reaction with further increase in time.

The vulcanized slabs were cut into bars approximately one inch wide by eight inches long which were then ground down to a nominal thickness of 0.125-inch by taking successive cuts from alternate sides of the specimen until the thickness had been reduced to the desired value. This was done on a drum sander using 100 grit abrasive cloth. Rough cuts 0.005-inch thick were taken until the specimen had been reduced to 0.130-inch thick. Finish cuts were 0.001-inch thick, and care was taken at all times to prevent overheating of the specimens. The specimens so prepared were representative of the material in the interior of the slab and were uniform in thickness to a tolerance of 0.001-inch of thickness. The ground specimens were cut to the contour of the paddle shaped specimens required for testing in accordance with ASTM D 530-57T[8] and were conditioned and tested dry in accordance with this method at a test temperature of 23° ±2° C.

The progress of vulcanization as a function of time, at the various sulfur levels used, was followed by arbitrarily selecting apparently significant increments of vulcanization time for each of the recipes and running tensile tests on the specimens so prepared.

The machine used in tensile testing was a Scott[10] Model Q horizontal tester operated at a jaw separation speed of 0.6-inch per minute. The mechanics of this machine are such that the extension of the specimen is performed by a draw-bar attached to one of the specimen grips. The specimen is stretched against a deadweight load attached to the other specimen grip by means of a pendulum linkage. As the load is applied, the pendulum is displaced so that the linkage moves in the direction of draw-bar travel as the load increases. This displacement is effectively subtracted from the total draw-bar travel and thus from the extension of the specimen as shown by the machine.

Modulus curves were drawn mechanically by the machine during test, but include the error mentioned as well as an additional error, owing to the fact that extension of some of the test specimens took place in or adjacent to the grips rather than within the measured test sections. In order to provide a means of compensating for these errors, the extension of the specimens was followed manually by means of calipers, and the caliper readings were recorded as the breaking strain. The machine drawn modulus curves for each set of specimens were averaged, corrections made for the errors

[9] W. J. Dermody, RUBBER WORLD, 138, 96 (1958); *Rubber Age (N. Y.)*, 83, 103 (1958). Abstract only.

[10] Scott Testers, Inc., Providence, R. I.

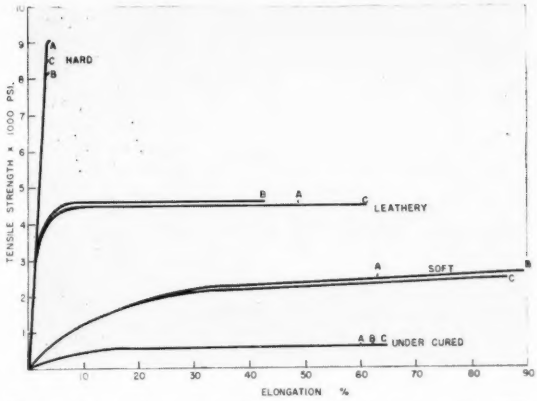


Fig. 2. Typical random breaks for four types of SBR 1000 hard rubber specimens varying from undercured to hard condition

mentioned, and the curves were redrawn on rectangular coordinates.

The values listed in the tables on the graphs for the various recipes in Figure 1 are for maximum tensile strength in pounds per square inch, elongation in percentage of the unstretched specimen, all corrected for machine error, and time of vulcanization in minutes at 165° C. No correction was made for the gradual reduction in cross-sectional area of the specimen during extension; accordingly all tensile values reported are "apparent" rather than true tensile strength.

Discussion of Results

Although the values for breaking stress for the various recipes, as shown on the graphs in Figure 1, appear in most cases to give the expected results, that is, a progressive increase in breaking stress values with increases in vulcanization time, the values obtained for the breaking strain for the various specimens comprising each sample vary widely and in a random manner. To some small degree this point may be discounted on the basis of specimen variation and testing error. In all probability the experimental strain values recorded at breaking stress approach to varying degrees, but do not always attain their theoretically possible limit. The breaking strain values recorded on the graphs in Figure 1, therefore, were maximum values because it was considered that these values were the closest approach to the theoretical.

The behavior of many of the specimens during test, as determined visually by observation of the type, number, and location of cracks and their propagation, would seem to justify the action of selecting the maximum strain values as the ones to record for a given sample and cure time. As breaking strain was approached, particularly on the softer specimens where it was possible to follow extension more precisely, it was observed that just prior to break a number of cracks developed in the specimen transverse to the direction of extension and that these cracks traveled across the specimen at an even rate characteristic of the hardness of the specimen. Failure occurred at a random extension and was dependent upon the location of the initial cracks relative to the edge of the specimen and to other cracks in the vicinity of the crack causing failure. Figure 2 illustrates the results of this phenomenon and failure at random extension for a typical series of specimens in the semi-hard and softer ranges particularly.

Highly vulcanized material such as the hard sample indicated in Figure 2 and the results for all of the specimens in Figure 1 containing 33% sulfur that were vulcanized for more than 30 minutes exhibit a contrasting type of brittle failure. This type of failure occurs at relatively low stress without compensating increase in strain and quite frequently at stresses lower than those of which the polymer is capable.

In connection with tensile modulus, each of the recipes investigated showed the expected progressive increase in these values with increasing degree of vulcanization. At an intermediate point in the range of vulcanization times investigated for all recipes above 15% sulfur

TABLE 2. VULCANIZABLE HYDROCARBON AND SULFUR EQUIVALENT CALCULATED FROM PRODUCER'S SPECIFICATION FOR SBR 1000

Specification	Min., %	Max., %
Volatile matter	—	0.5
Ash	—	1.5
Fatty acid	3.75	6.0
Soap	—	0.75
Antioxidant	1.00	1.75
Total non-polymer	4.75	10.50
Polymer (by difference) (A)	95.25	89.50
Total rubber, (B)	100.00	100.00
Bound styrene in polymer[11]	22.50	24.50
	Max., %	Min., %
Butadiene in polymer, (C)	77.5	75.50
Rubber, (A x C)	73.8	67.60
Vulcanizable hydrocarbon, 1,4-butadiene (82% of combined butadiene[12]) 0.82C = D		
In polymer, (D)	63.6	61.9
Rubber, (A x C)	60.6	55.4
Stochiometric sulfur based on 1,4-butadiene		
Maximum vulcanization coefficient $\frac{\text{Sulfur, } 32.06}{\text{Butadiene, } 54.09} = E$	PPH	PPH
On Polymer, E x D	37.7	36.7
Rubber, E(A x D)	35.9	32.8
% Sulfur for complete vulcanization in recipes containing only sulfur and:		
Polymer, $\left(\frac{E \times D}{100 + E \times D)} \times 100\right)$	27.3	26.8
SBR 1000, $\left(\frac{E(A \times D)}{100 + E(A \times D)} \times 100\right)$	26.4	24.7

[11] J. W. Livingstone, and J. T. Cox, Jr., in "Synthetic Rubber," G. S. Whitby *et al.*, p. 208.
[12] C. S. Marvel and H. E. Baumgarten, *Ibid.*, pp. 292-99.

content, a tendency toward rapid change in the character of the obtainable properties with small increases in the degree of vulcanization was noted. The point and cure time at which this occurred decreased as the sulfur content of the recipes increased, for example, 180 minutes at 18% sulfur, 120 minutes at 20% sulfur, 92 minutes at 22% sulfur, etc.

Calculation of Vulcanizable Content of SBR

The producer's specification range of chemical composition of the SBR 1000 used was employed in calculating the maximum and minimum polymer content which might be expected in commercial rubbers of this type. The butadiene content[11] and finally the 1,4-butadiene[12] or vulcanizable portion of the polymer as well as the stochiometric sulfur required to vulcanize this 1,4-butadiene were calculated as shown in Table 2. It should be noted that although Marvel and Baumgarten[12] summarize the data that they present as indicating ca. 80% 1,4-butadiene addition during the polymerization of SBR of the 1000 type, we have used an 82% figure, the highest value which the data might justify for polymers of this type. The purpose of using the 82% figure was to reduce the possibility of underestimating the amount of sulfur required for complete vulcanization.

The assumption was made that any butadiene which had added to the polymer by 1,2- addition was not vulcanizable by sulfur under the experimental conditions used in this work, because of the lower reactivity of the vinyl groups formed on the polymer chain as a result of 1,2- addition as compared to the in-chain unsaturation resulting from 1,4-butadiene addition. This hypothesis appears to be more tenable than that of assuming cyclization[13] of the polymer, especially in the absence of conclusive proof of cyclic structures.

Table 3 develops data for the lot of SBR 1000 used in the same manner as was done in Table 2 for SBR 1000 from the producer's specification range. The stochiometric sulfur equivalents in both tables was calculated on the basis of one mole of sulfur reacting with one mole of 1,4-butadiene in the SBR.

The experimental findings reported in this paper appear to substantiate the combining ratios for SBR 1000 and sulfur, whether calculated on the producer's specification range for the polymer or the analysis of the particular lot of SBR 1000 used. Reference to the results in Figure 1 for the 22% and 28% sulfur recipes shows that at complete vulcanization in our accelerated recipe there is a little over 300 psi. difference between the tensile strength at break of the 22% sulfur recipe specimens as compared to those in which 28% sulfur was used. Additional vulcanization of these recipes beyond the longest vulcanization times shown in the graphs did not produce increases in tensile strength, but rather the type of embrittlement shown with the 33% sulfur recipe specimens vulcanized longer than 30 minutes. We are justified, therefore, in concluding that the maximum cure times shown for the 22% and 28% sulfur recipes represent complete vulcanization.

It follows also that since 22% sulfur produces essentially the same effect as 28% when the reaction is carried to completion, then 22% sulfur is all that is actually required. In Table 1 our accelerated recipe proportion of 22% sulfur is shown to be equal to 29.3 parts sulfur on 100 rubber or 31.2 parts on 100 of polymer. This 31.2 parts sulfur on 100 polymer in the recipe is below the minimum amount of sulfur (36.7) required completely to vulcanize pure polymer according to Table 2, and the 29.3 parts sulfur on 100 rubber in the recipe is also lower than the 32.8 parts sulfur required for SBR 1000 containing 10.5% unvulcanizable material in Table 2. Additional confirmation of the fact that only 22% sulfur is required for complete vulcanization is found in the value for breaking stress of the 20% sulfur recipe specimen vulcanized for 1000 minutes in Figure 1, which value is in the range reached by the 22% and 28% sulfur recipe specimens for complete vulcanization.

TABLE 3. VULCANIZABLE HYDROCARBON AND SULFUR EQUIVALENT FOR SBR 1000 USED

Polymer in accelerator master-batch, (A)	90.44%	
SBR 1000 used, (B)	94.06%	
Bound styrene in polymer	22.5% min.	24.5% max.
Butadiene by difference, (C)	77.5% max.	75.5% min.
Vulcanizable hydrocarbon, 1,4-butadiene (82% of combined butdiaene)	Max., %	Min., %
In Polymer, (D)	63.6	61.9
Rubber, (B x D)	59.8	58.2
Stochiometric sulfur on 1,4-butadiene	PPH	PPH
Maximum vulcanization coefficient $\frac{\text{Sulfur, } 32.06}{\text{Butadiene, } 54.09} = \text{E}$		
On Polymer, E x D	37.7	36.7
Rubber, E(B x D)	35.4	34.5
% Sulfur for complete vulcanization in recipes containing only sulfur and:		
Polymer, $\left(\frac{\text{E x D}}{100 + \text{E x D}} \times 100\right)$	27.4	26.8
SBR 1000, $\left(\frac{\text{E(A x D)}}{100 + \text{E(A x D)}} \times 100\right)$	26.2	25.7

Summary and Conclusions

We appear to be justified from the calculations in Table 2 in stating that for SBR 1000, recipes in which the sulfur on 100 of polymer is between 37.7 and 36.7 parts (35.9 and 32.8 parts on the rubber) are capable of producing complete vulcanization of the available unsaturation in the polymer. These proportions are equivalent to between 26.4 and 24.7% sulfur in a hypothetical unaccelerated mixture of SBR 1000 and sulfur, as indicated also in Table 2. For the particular lot of

[11] P. Stocklin, *Trans. Inst. Rubber Ind.*, 15, 51 (1959).

SBR 1000 used in this investigation the corresponding values are 37.7 to 36.7 parts of sulfur on 100 polymer (35.4 to 34.5 parts on the rubber), as calculated in Table 3, and 26.2 to 25.7% sulfur in an unaccelerated mixture of SBR 1000 and sulfur.

All of these values are appreciably lower than the 47 parts sulfur required to vulcanize 100 parts of natural rubber to ebonite. These proportions, with little more than a concession that an SBR containing approximately 25% styrene will be saturated by three-fourths as much sulfur as required to produce natural hard rubber, form the basis for many of the existing commercial SBR formulations for hard rubber.

The powerful accelerating effect of excess sulfur in a recipe strongly indicates the virtual impossibility of consistently reproducing a given set of properties in samples of any recipe short of complete vulcanization of the polymer. It is similarly indicated that reproducibility of properties in low-sulfur hard-rubber recipes may be reliably achieved through protracted vulcanization in the presence of just sufficient sulfur to produce the desired properties upon complete combination of the available sulfur.

It appears clear also that the definition of the stochiometric sulfur requirements of an SBR ebonite recipe may benefit from a calculated estimate of the vulcanizable butadiene portion of the polymer rather than a too-ready acceptance of rule-of-thumb or past practice. We may speculate also that a more rigorous examination of the polymer will show a still lower proportion of the total amount of unsaturation present to be vulcanizable under the experimental conditions used, or that our estimate of polymer content of the rubber is too high by a factor approaching 8-10% of the calculated value. Such speculation would be encouraged by the high tensile strength obtained on the 20% sulfur recipe after 1,000 minutes' vulcanization at 165° C., and by the fact that we have minimized the possibility of negative error in our calculation of sulfur requirements in Table 2 and 3 by arbitrarily taking the higher values from the data compiled by Marvel and Baumgarten for figuring the amount of vulcanizable unsaturation.

The sulfur content of the majority of commercial SBR ebonite recipes probably lies in the range of 35 to 50 parts per 100 rubber, and therefore they contain more sulfur than is necessary for full vulcanization.

The data reported in this paper suggest strongly also that much of the reputation for brittleness in completely vulcanized SBR ebonites, which has been attributed to an inherent characteristic of this polymer, may more reasonably be explained by the presence of an unnecessary excess of sulfur in the recipe.

In Memoriam—Philip Schidrowitz

The Stress-Strain Curve of Rubber—An Allegory by W. B. Wiegand

In my first encounter with the stress-strain curve of rubber I considered its dynamics, in my second, its thermodynamics; now, a look at its human dynamics. As I stretch this inner-tube band to increasing elongations, I ask that you divide each value by ten to reach the corresponding age of man.

First, then, the early curve.

From zero to 300%—from birth to age 30—increasing strains induce but minor stresses; the curve is mild, recovery from strain and stress is quick and complete; statistical probability—state of disorder—remains high. In rubber, as in life, the early curve is gentle, high in probability, but low in structure, high in elasticity, but low in useful energy—a time of gay and happy randomness!

Next, the middle curve.

Now, I stretch the band from 300 to 600%—age 30 to 60. The curve has stiffened; like strains induce greater stresses; hysteresis is marked—the snap-back of youth gives way to the more sluggish recovery of middle age. Inner changes appear. Entropy and internal energy decline steeply, owing to orientation, with thermal loss; the bodily heat of youth subsides. But a new property appears, the faculty of transforming heat into useful work. The middle curve is the region of the rubber heat engine. The middle years are the creative years, when the random ardors of youth are transmuted into orderly accomplishments; when there are more light, if less heat, more direction, if less motion. The middle curve, the middle years, are the most prolific, for rubber and for man.

Finally, the later curve.

Now I am tugging hard—at 600% and beyond; age 60 and over. The curve is steep, almost sheer. Added strains may bring dangerous stresses. Recovery is slow and incomplete. Entropy and internal energy are touching bottom. Owing to friction the rubber pendulum will die down. Man, in his sixties, slows his pace. Productivity and statistical probability have fallen far. The outlook for the later curve looks grim, but, wait, the X-ray shows that crystals have appeared in which, in rubber, form the fibers of self-reinforcement. So too, maturity brings crystallization of our beliefs. In rubber and in man, order and alignment have replaced chaos and confusion. Linearity, plan, and pattern have appeared to bolster and reinforce. We have lost statistical probability, but, in its stead, we may have gained a vision of our destiny.

Our stress-strain curve must terminate, but how? By rupture and failure, with broken pieces left behind? This must follow if we endlessly prolong our strains and stresses, forcing our curve beyond its natural course, striving to add, by antioxidants or antibiotics, another inch, or year.

"Pass then through this little space of time conformably to Nature, and end thy journey in content, just as an olive falls when it is ripe, blessing Nature, who produced it, and thanking the tree on which it grew."

Shall we not also—following the fifth Antonine—be wiser to relax our iron grip, and, at our appointed time, release and let go our stress-strain curve, ready and prepared for a confident, resilient leap—like yours, dear Philip—into the Great Beyond?

meetings and reports

Rubber Division, ACS,

New York Meeting To Feature Symposium on Reinforcement, Special Lectures

The fall meeting of the Division of Rubber Chemistry of the American Chemical Society will be held with the parent Society in New York, N. Y., during the week of September 11. The Rubber Division will meet Wednesday, September 14, through Friday, September 16, at the Commodore Hotel.

The Division's first technical session will start at 2:00 p.m. on September 14, with Chairman W. J. Sparks, Esso Research & Engineering Co., presiding. This session will be preceded by a luncheon-meeting of the Division's 25-Year Club, with J. M. Ball, Midwest Rubber Reclaiming Co., the chairman for that meeting. Ervin S. Kern, R. T. Vanderbilt Co., is chairman of the local committee on arrangements for the New York meeting.

Chairman Sparks has arranged with Prof. Maurice Morton, director of the Institute of Rubber Research, University of Akron, Akron, O., to headline the first session on September 14 with a lecture on "Recent Developments in Anionic Polymerization." The Division chairman has arranged with Prof. C. S. Marvel, of the University of Illinois and former president of the Society, to highlight the technical session on the afternoon of September 15 with a lecture on "Recent Developments in High-Temperature Rubbers."

In addition to these two special lectures, a symposium of five invited papers on "Reinforcement" will also be presented on the afternoon of September 15. Other features of this New York meeting will be the announcement of the results of the letter-ballot for election of officers and directors and the announcement of the selection of the recipient in 1961 of the Division's Charles Goodyear Medal Award for contributions to the science or technology of rubber or related subjects. The award for the best paper presented at the May, 1960, Buffalo, N. Y., meeting will be made by Chairman Sparks at the business meeting of the Division on Thursday, September 15, at 11:00 a.m.

As a result of a recent decision of the executive committee of the Rubber Division, there will be no banquet, nor will there be a suppliers' cocktail party at the New York meeting. The Division is now following a policy of having a banquet only at the spring meetings, at which time the annual Charles Goodyear Medal Award presentations will be made.

The next meeting of the Rubber Division will be held in Louisville, Ky., April 18-21, 1961, and the deadline for abstracts of papers for that meeting is February 20, 1961, according to L. H. Howland, assistant Division secretary, Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.

Program and Abstracts of Papers

Wednesday Morning—September 14

9:00 a.m. Registration.

11:30 a.m. 25-Year Club Luncheon. J. M. Ball, presiding.

Wednesday Afternoon—
September 14
New Polymers
W. J. Sparks, Presiding

2:00 p.m.—1. Introductory Remarks. W. J. Sparks, Division chairman.

2:10 p.m.—2. Invited Paper. Recent Developments in Anionic Polymerization. Maurice Morton, University of Akron, Akron, O.

The recent growth in the applications of anionic polymerization for the synthesis of new polymers has been largely due to new knowledge which has become available about these systems.

The two outstanding features exhibited by the reaction of carbanions with unsaturated monomers are stereospecificity and absence of chain termination. The former has made it possible to synthesize polymers having regulated chain structure, e.g., *cis*-polyisoprene, through the use of Ziegler-Natta type of catalysts or lithium compounds. The latter has resulted in a very high degree of control over the molecular weight distribution of these polymers. Hence it has been possible to attain the twin objectives of control of chain structure and molecular size to a greater extent than ever before.

The mechanism responsible for these features apparently differs sharply from that of free radical and carbonium ion polymerizations. The homogeneous anionic polymerizations are considered to proceed through successive additions of monomer units to an ion pair, which may not undergo any real termination step. Hence the polymerizing chains continue to grow as long as any monomer is present. Furthermore such ion pairs, whether in homogeneous solution, or at a solid-liquid interface, may be specific toward the steric conformation of incoming monomer units.

2:50 p.m. — 3. Ethylene-Propylene Rubber. L. O. Amberg[1] and A. E. Robinson, Hercules Powder Co., Wilmington, Del.

Copolymers of ethylene and propylene can be prepared over a wide range of composition and molecular weight. They vary in properties from tough, semi-rigid materials through typical elastomeric rubbers to balsamic gums. The elastomers containing 60 to 70 mole % ethylene process such as conventional rubbers are relatively easy to cure with peroxides and have good vulcanizate properties. Those with preferred molecular weights have reduced specific viscosities of 3 to 4 (0.1% in Decalin at 275° F.) and Mooney viscosities (ML-4, 212° F.) of 30 to 45. These polymers are believed to have an amorphous linear structure substantially free of long-chain branching and residual unsaturation. Best properties appear to result from narrow molecular weight distribution and high uniformity of composition. Specific gravity of the copolymer is about 0.87.

Ethylene-propylene rubber, being a saturated hydrocarbon, is inherently stable chemically. Heat resistance of its vulcanizates is good, and it is many times more ozone- and weather-resistant than nitrile rubber, SBR, and natural rubber and considerably better than

[1] Author's name in bold face indicates person presenting paper.

butyl rubber. Tensile properties are in the SBR range, but tear strength is about 70% of SBR. Preliminary data from other laboratories indicate that wear and abrasion properties are good in comparison with those of SBR and natural rubber. Building tack is poor at room temperature.

Ethylene-propylene copolymers do not break down readily under shear or with peptizers. Consequently, a somewhat lower raw polymer viscosity is needed compared with SBR or equivalent compound processability. Otherwise ethylene-propylene copolymers process much like SBR, but need more tackifier. Bonds to butyl are fairly good. With SBR and natural rubber a tie gum layer is needed to resist delamination on thick sections as in tire treads.

Ethylene-propylene copolymers require a free-radical curing agent such as dicumyl peroxide (Hercules Di-Cup). A small amount of sulfur improves the cure. Pigment reinforcement occurs as with SBR. Choice of pigments, plasticizers, and other accessory materials is governed by the chemistry of the free-radical curing agent. Oil extension of high-viscosity polymer is comparable to oil extension of SBR; naphthenic and paraffinic oils, however are preferred.

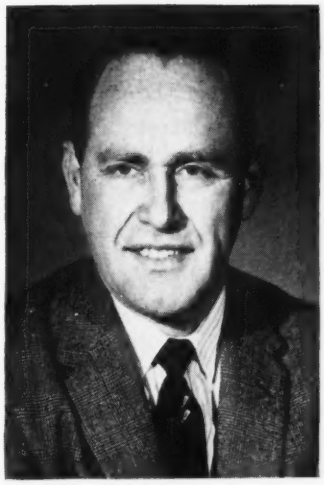
The properties of ethylene-propylene elastomers indicate that they should be useful in a wide range of products such as tires, mechanical goods, belting, and wire coating. Good resistance to ozone and discoloration should make them attractive in non-black products. With the peroxide cure, they appear to be excluded from uses where low-temperature cures and air cures are required.

3:15 p.m.—4. Vulcanization and Properties of Trifluoronitrosomethane-Tetrafluoroethylene Elastomer. J. C. Montermoso, C. B. Griffis, Angus Wilson, G. H. Crawford,[2] Quartermaster Research & Engineering Center Laboratories, Natick, Mass.

There is an urgent need of new elastomers which will meet the current and future requirements of military operations. Rubbers are being sought which possess a combination of two or more of the following characteristics: (1) chemical resistance, (2) low-temperature flexibility, (3) thermal stability at high temperatures, (4) flame retardance, and (5) radiation resistance. The work reported in this paper on fluorinated nitroso rubber is directed toward this objective.

A copolymer of trifluoronitrosomethane-tetrafluoroethylene is an elastomer having a molecular weight of more than a million, as determined by light scattering techniques. The rubber contains no hydrogen. It has an entirely new type of structure with a -N-O-C-C- in the backbone of the molecular chain.

Vulcanization methods, including data on physical properties, will be presented. Results obtained thus far show the rubber to be non-flammable and to possess a good combination of chemical resistance and low-temperature flexibility.



Maurice Morton

3:30 p.m.—5. Preparation of Crystalline Polyaldehydes. Junji Furukawa, Takeo Saegusa, and Hiroyasu Fujii, Kyoto University, Kyoto, Japan.

Previously we reported that by γ-alumina, acetaldehyde was polymerized to an elastomeric polymer. The configuration of the carbon atom of the main chain of this polymer was thought to be irregular. It has been assumed, therefore, that there can exist stereoregular (crystalline) polyacetaldehyde besides the irregular (amorphous) form.

By using organometallic compound as the catalyst we succeeded in the preparation of crystalline polyacetaldehyde. The polymerization was carried out at a lower temperature, e.g., at the temperature of a solid carbon dioxide-acetone bath.

The polymer thus obtained was found to be crystalline by X-ray diffraction. From infrared spectrum data the crystalline polymer is found to have the same structure (methylpolyoxymethylene) as that of the amorphous polymer, but the absorption with the crystalline polymer is much sharper and intenser than with the amorphous material.

In solubility the crystalline polymer differs markedly from the amorphous variety. The amorphous polymer is easily soluble in common organic solvents; while the crystalline polymer is resistant to such solvents, except for partial solubility in chloroform.

Other aldehydes, such as propionaldehyde and trichloracetaldehyde were also polymerized to crystalline polymers by the use of organometallic compounds.

It is suggested that the active species in the polymerization is the corresponding metal alkoxide, and it was found that some of the metal alkoxides were active catalysts for the polymerization of aldehydes.

3:55 p.m.—6. Effect of Isocyanate Structures on Cured Polyurethane Properties. C. F. Blaich, Jr., and A. J. Sampson, The Carwin Co., North Haven, Conn.

Urethane elastomers are finding increased usage in industry because of their excellent physical properties. Most urethane elastomers used by industry today are based on toluene diisocyanate, TDI, or methylene-bis-(4-phenylisocyanate), MDI. Necessary variations in physical properties of the urethane elastomers have been obtained by either varying other reactants in prepolymer formation or by variation in curative systems.[3]

In a recent program to determine the effect of isocyanate structure on urethane properties, 3,3′-dimethyl biphenyl diisocyanate; 3,3′-dimethoxy biphenyl diisocyanate; biphenyl diisocyanate; 3,3′-dimethoxy, 4,4′diphenylmethane diisocyanate; 3,3′-dimethyl, 4.4′-diphenylmethane diisocyanate; p-phenylene diisocyanate; m-phenylene diisocyanate; m-xylylene diisocyanate; decamethylene diisocyanate; toluene diisocyanate, and polymethylene polyphenylisocyanate were evaluated as ingredients in urethane prepolymers. These isocyanates were reacted with known, commercially available polyesters and/or polyethers.

These urethane prepolymers were cured with conventional amine curing agents and were evaluated by standard ASTM tests. The effect of isocyanate structure on hardness, tensile strength, ultimate elongation, stress-strain characteristics, tear strength, compression set, solvent resistance, and temperature resistance was determined.

Test results indicate that isocyanates of the biphenyl structure, such as 3,3′-dimethyl, 4,4′-biphenyl diisocyanate imparted drastically improved stress-strain characteristics, ultimate tensile strength, solvent and temperature resistance. The type of substitution in the position ortho to the isocyanate group of the biphenyl affected directly the polymer properties, particularly the stress-strain relations.

Urethane prepolymers based on toluene diisocyanate or 4,4′-diphenylmethane diisocyanate may be modified with the biphenyl-type diisocyanates to yield decidedly improved properties. Polymethylene polyphenylisocyanate could not be used to form a stable prepolymer; however, when used in a "one shot" system, urethane polymers with 400° F. volume stability were

[2] Minnesota Mining & Mfg. Co., St. Paul, Minn.

[3] "Effect of Amine Structure on Properties of Cured Polyurethanes," A. J. Sampson and C. F. Blaich, Jr., presented before the Rubber Division, ACS, May 5, 1960, Buffalo, N. Y.

formed, although these polymers had poor tear strength.

All prepolymers were formulated to yield viscosity and stability characteristics amenable to commercial use in conventional mixing equipment. Also, all prepolymers were made by normal prepolymerization techniques in conventional equipment.

4:15 p.m.—7. A Study of First- and Second-Order Transition in Neoprene.[4] **R. M. Murray** and J. D. Detenber, E. I. du Pont de Nemours & Co., elastomer chemicals department, Wilmington.

The first- and second-order transition of neoprene was studied to understand better the low-temperature behavior of neoprene vulcanizates.

First-order transition of several types of neoprene was measured by change in volume (dilatometrically), durometer hardness, Young's modulus, and cold compression set. The effect of temperature on rate of crystallization for Types GN and W vulcanizates was determined. The optimum crystallization temperature was found to be —12° C. It was shown that the temperature at which a vulcanizate is crystallized determines the minimum temperature at which it will thaw; the thaw point is approximately 15° C. higher than the crystallization temperature. Increased state of cure was shown to decrease crystallization rate.

Compounding variables studied included the effect of sulfur, and type and amount of loading and plasticizer. Low-temperature plasticizers were shown to increase crystallization rate to varying degrees. Delayed stiffening at —40° C. was shown to result from crystallization favored by the presence of low-temperature plasticizers rather than the phasing-out of the plasticizer due to incompatibility at low temperatures, as previously believed. The brittle point was not changed as a result of crystallization.

Second-order transition was studied using Clash-Berg torsional stiffness, durometer hardness, and cold compression set tests. Brittle point was shown not to be directly related to second-order transition. Brittle point and second-order transition temperature were determined for vulcanizates of the general-purpose neoprenes.

4:35 p.m.—8. Magnesium Oxides in Chlorobutyl. W. H. Deis and L. F. Heneghan, Merck & Co., Inc., Marine Magnesium Division, South San Francisco, Calif.

Magnesium oxide functions in many chlorobutyl rubber compounds as a scorch retarder and as a stabilizer to improve retention of properties during high-temperature exposure. This study was made to explore the optimum amount and type of magnesium oxide best suited for various chlorobutyl compounds and to establish magnesium oxide properties critical to performance.

This paper summarizes the results obtained with various levels and types of magnesium oxide, curatives, fillers, and retarders and correlates these results, in both black and non-black compounds, with the properties of the magnesium oxide. Retardation of scorch and cure rate in black compounds is related to the characteristics and amount of magnesium oxide and to the curative system. Quite surprisingly, magnesium oxide functions both as a scorch retarder and as a vulcanizing agent in certain non-black compounds and gives results very similar to those obtained with organic promoters. In these compounds heat interaction is not necessary for obtaining the promoter effect, and the compounds do not discolor. Magnesium oxide can replace zinc oxide in certain compounds to give a better overall balance of properties. Magnesium oxide reduces surface cracking and surface tack which often occur in non-black compounds during outdoor exposure.

There is a definite correlation between surface activity (iodine adsorption) of magnesium oxide and its performance in chlorobutyl rubber. Results can also be affected, however, by the curative and retarder systems employed in black and non-black compounds and by fillers in non-black compounds. Results of our study of these variables in basic formulations will be presented and represent a definite contribution to the compounding knowledge of chlorobutyl rubber.

Thursday Morning—September 15
Reinforcement and General Papers
J. Rehner, Presiding
Reinforcement Symposium

9:00 a.m.—9. Invited Paper. Modern Role of the Electron Microscope in Rubber Research. W. A. Ladd and M. W. Ladd, Ladd Research Industries, Inc., Roslyn Heights, N. Y.

Until recently the main role of the electron microscope in rubber research was the determination of particle size and shape of reinforcing pigments and fillers, carbon reticulate structure, and latex particle size and ultimate dispersion. Improvements in resolution and development of new techniques and accessory equipment for the electron microscope have changed this role greatly. Today, carbon particle structure, as contrasted to reticulate chain structure, can be studied, and the effect of oxidation, excessive heat treatment, and even the porosity of carbon black, can be examined. Clues to the actual process of carbon particle formation can be obtained.

Freezing and fracturing techniques permit the study of typical dispersions in rubber; whereas previously only ultimately good dispersions, often misleading, were seen. Stereo-micrograph is an invaluable tool in the study of these surfaces. Cooling units for use in evaporators permit the replication and examination of low melting point materials, e.g., accelerators, etc. Dynamic studies, such as the stretching of thin reinforced rubber films, are now possible.

Holders that can be heated to 600 to 1000° C. eliminate one of the major difficulties in the study of carbon blacks: namely, contamination or build-up in the microscope itself. Such contamination has been indeed a serious handicap, particularly in work with SAF or other fine particle size carbon blacks. Holders for low melting point materials are also available.

The electron microscope today is no longer a static, but a dynamic tool with great new horizons for the study of reinforcement. At present, controlled experiments to interpret fully what high resolution is constantly revealing is one of the prime requisites.

9:25 a.m.—10. Invited Paper. The Effects of Carbon Black Structure on Tire Tread Wear. Thomas D. Bolt and Eli M. Dannenberg, Godfrey L. Cabot, Inc., Boston, Mass.

Carbon black structure has been shown to affect such rubber properties as viscosity, processing smoothout, modulus, and hardness.

The carbon black industry recently introduced new low-structure oil furnace blacks in the particle size range of HAF, ISAF, and SAF blacks. These new carbon blacks are of interest in tire treads for obtaining low hardness and quiet, soft-riding performance. Since the development of soft treads has been associated at times with a loss in tread wear resistance, the road test performance of treads incorporating carbon blacks at several levels of carbon black structure and loading has been investigated. Also, since relative tread wear resistance is expected to vary with the severity of the road tests, tread performance is assessed at different rates of wear.

It is shown that low-structure oil furnace blacks can provide low hardness treads with the wear resistance of an ISAF black tread over a range of road test severities. The use of lower carbon black loadings and lower carbon black structure in tire treads at very high rates of wear results in some decrease in road wear performance.

9:50 a.m.—11. Invited Paper. The Chemistry of Carbon Black in Rubber Reinforcement. C. W. Sweitzer, K. A. Burgess, and F. Lyon, Columbian Carbon Co., New York, N. Y.

The chemistry of carbon black in rubber reinforcement has received increasing attention in recent years. This interest has followed from a better understanding of the chemical nature of the carbon black surface and the recognition that chemical interactions involving carbon black play a significant role in reinforcement.

[4] Contribution No. 171 of the Du Pont elastomers laboratory.

Investigations have involved the identification of specific oxygen functional groups on the surface of the particles as well as the nature of the carbon black surface itself. Studies have shown that these functional groups, as well as the nature of the carbon surface, responsible for the interaction between carbon black and rubber during mixing and vulcanization, have profound effects on final vulcanizate properties.

The interdependence of surface chemistry and structure in developing certain rubber properties has been established. This fact has led to the more exacting control of surface chemistry, as well as particle size and structure, for the development of the most effective carbon blacks for all rubber applications.

10:15 a.m.—12. Invited Paper. Peroxide and Radiation Cured Compounds Filled with Reinforcing Fine Particle Silica. J. W. Sellers, M. P. Wagner, B. J. DeWitt, C. C. Stueber, J. H. Bachmann, Columbia-Southern Chemical Corp., Barberton, O.

There are indications that the chemical reaction involved in bound rubber formation proceeds by a free-radical mechanism for compounds filled with reinforcing hydrated fine particle silica, as in the case with carbon black. The high potential of silica to reinforce is indicated by its bound rubber formation. Evidence of filler-polymer interaction was obtained in filled vulcanizates cured by peroxide and by high energy radiation, respectively. Both of these relatively simple curing systems are postulated to effect cross-link formation via a free-radical mechanism.

A logical measure of the ability to reinforce is the value, after cure, of the ratio of the cross-link density of the filled compound to the cross-link density of the respective unfilled compound, η/no. In silica filled natural rubber compounds (30 vol.) values of η/no were obtained as follows: for peroxide cure, 1.5 to 1.8; for radiation cure, 3.8. Comparisons are made with similarly cured HAF black filled stocks. Sulfur-cured natural rubber stocks filled with HAF black (30 vol.) generally exhibit η/no values in the range of 1.5 to 2.0.

Comparative effects of antioxidants are described also.

10:40 a.m.—13. Invited Paper. Attrited Carbon Blacks and Their Behavior in Elastomers—Part 3. A. M. Gessler, Esso Research & Engineering Co., Linden, N. J.

Severe attrition of carbon blacks produces important changes in the physical and chemical properties of the blacks. The resulting alterations in surface area, aggregate structure, surface oxygen content, and pH lead to significant modifications in the reinforcing capacities of the blacks.

Earlier work has shown that in butyl rubber attrited blacks yield greatly improved stress-strain properties and dynamic behavior. In addition, cure rate is enhanced to the extent that it is very nearly comparable to that of SBR.

C. S. Marvel

Similar improvements are not directly translated to SBR. Severe cure retardation and inferior properties are experienced. This difficulty is circumvented, however, through special techniques which will be described.

Attrited black-SBR systems display excellent cure rates, tensile strength, extensibility, and hysteresis properties. In addition, they possess the advantage of reduced modulus and hardness. These and other properties of SBR systems will be discussed in terms of changes occurring (through attrition) in the aggregate structure of the black, and the nature of the polymer-black surface interaction.

General Papers

11:05 a.m.—14. Ultrafine Talc/SAF Black Mixtures in SBR 1500 Vulcanizates. R. S. Lamar, H. T. Mulryan, and **M. F. Warner,** Sierra Talc Co., South Pasadena, Calif.

Additions of ultrafine talc to SAF black in SBR 1500 compounds eliminate "nerve" and markedly reduce Mooney viscosity and heat buildup on the mill. Extrudability and general processability of such compounds are improved also. Ultrafine talc, because of its unique physical structure, acts as an internal lubricant and permits particles of carbon black to slide past one another in the compound.

SBR 1500 vulcanizates, containing mixtures of ultrafine talc and SAF black, show increased tensile strength and greater elongation than when SAF black is used alone in the compound, and under certain conditions modulus values and tear resistance of the ultrafine talc/SAF black vulcanizates are improved. It is believed that the ultrafine talc assists in the dispersion of the black particles, disrupts the carbon-to-carbon chain-like structures, and increases the extent of the carbon/polymer interface.

Similar results have been obtained with ISAF and HAF blacks in various mixtures with ultrafine talc in SBR 1500.

11:25 a.m.—15. The Pico Abrasion Test for Rubber Stocks. E. B. Newton and D. S. Sears, B. F. Goodrich Co. Research Center, Brecksville, O.

The Pico abrasion test is unique, as far as the authors know, in that it will evaluate different polymers in addition to the usual differentiation of reinforcing agents in the same polymer. The machine consists basically of two parallel tungsten carbide blades set to the right and to the left of the center of rotation of the cylindrical test piece and held in contact with it by a weight. Silica dust is sifted on to the sample during the test.

Comparisons of abrasion resistance of stocks under test are made on a volume-loss basis (determined gravimetrically) against the five stocks used to calibrate the machine. These five calibration standards are as follows: natural rubber-EPC black (arbitrarily based index of 100); hot SBR-EPC black (index 90); cold SBR-EPC black (index 110); cold SBR-HAF black (index 125); and cold SBR-SAF black (index 150). It will be seen that these standards are combinations of three different polymers and three different blacks.

The indexes assigned to these stocks are based on results of tire tests run at 60 mph. on passenger cars on Texas roads. That is to say, the indexes are based on one, perhaps somewhat approximate degree of severity. If the severity of the road test is changed, the relative indexes have to be changed.

In general, the test has provided a good differentiation of unknown tread stocks at the laboratory level. Allowing a spread of $\pm 10\%$ from a true correlation, Pico indexes run on tread ribs cut from test tires have agreed quite well with road results. The severity of the Pico test can be altered by changing the weight on the knives, and this procedure has been used further to differentiate stocks. For example, at low severity (that is using a light weight), cast polyurethane stocks show much higher abrasion resistance than the natural rubber-EPC black control does; but at high severity, polyurethane stocks are relatively poorer than the natural rubber stock although the actual volume loss of each stock increases. A reverse order is obtained with SBR tread stocks because they show higher abrasion resistance at high severity than does the natural rubber tread. These two trends agree with service tests.

11:45 a.m. Business Meeting. W. J.

Sparks, Presiding. Best Paper Award from Buffalo Meeting. Necrology.

Thursday Afternoon—September 15
Rubber Chemistry
W. S. Coe, Presiding

2:00 p.m.—16. Invited Paper. Recent Developments in High-Temperature Rubbers. C. S. Marvel, University of Illinois, Urbana, Ill.

Rubbers of the past have not been very useful where applications involving high temperature were involved, and this situation was particularly true of natural rubber. Some of the synthetic elastomers turned out to fit some of these high-temperature applications better than natural rubber, but they were still not good enough.

Also, new applications developed, such as jet planes, rockets, and space-age material in general, that required heat resistant elastomers better than anything available in the past, and which had to be designed specifically for the job. This situation has led to a great amount of research on elastomeric polymer to withstand very high temperatures, and this talk summarizes the newer developments in this field.

2:40 p.m.—17. Reaction of Sulfur, Hydrogen Sulfide and Accelerators with Propylene and Butadiene. F. J. Linnig, E. J. Parks, and L. A. Wall, National Bureau of Standards, Washington, D. C.

The work reported in this paper was undertaken as part of a study of the processes involved in vulcanization. Previous infrared studies have shown that sulfur vulcanizates have conjugated double bonds, which are reduced in amount when accelerators such as zinc dimethyldithiocarbamate are used. In the present work, propylene has been used as a model compound for the original olefin in rubber, and butadiene as a model compound for the conjugated system acting as an intermediate. These compounds have been reacted with sulfur alone, with hydrogen sulfide alone, and with each of these materials in the presence of a vulcanization accelerator as well as free radical accelerators to explore the mechanisms of the reactions.

The results of mass spectrometer analyses indicate the formation of sulfides, disulfides, and carbon-to-carbon bonds. Zinc dimethyldithiocarbamate used as a vulcanization accelerator produces hydrogen sulfide from the olefin or diolefin, and in turn, accelerates the reaction of hydrogen sulfide with olefin or diolefin. The accelerated reaction between the diolefin and hydrogen sulfide is complete and may account in part at least for the decreased conjugation in accelerated vulcanizates. Certain aspects of the reaction do not appear to be free radical in nature, including the formation of diisopropyl sulfide from propylene and sulfur and from propylene and hydrogen sulfide. Other phases of the reaction involve the formation of sulfide and other linkages from what appear to be free radical fragments of the original molecule.

This last conclusion is more applicable to the reactions with the intermediate conjugated system than to the reactions with the original double bond. Electron spin resonance studies with sulfur compounds confirm the presence of free radicals.

3:05 p.m.—18. Evaluation of Progressive Changes in Elastomer Properties during Vulcanization. W. E. Claxton, **F. S. Conant,** and J. W. Liska, Firestone Tire & Rubber Co., Akron, O.

An apparatus and a method are described for evaluating state of cure, optimum cure time, rate of cure, induction time for cure, scorch time, induction time for reversion, reversion rate, and degree of reversion of elastomeric compounds. Coincident with these determinations vulcanizate specimens are prepared on which more conventional physical test data may be obtained, e.g., compression modulus, compression set, hardness, specific gravity, tensile modulus, and elongation.

In essence, the method described provides a progressive measure of modulus change during cure or reversion through the change in deformation of a periodically loaded plunger, one end of which is embedded into the specimen. Typical results are given which show application of the apparatus to screening tests, millroom control, reversion studies, and to compounds too stiff for conventional test methods.

Demonstrated advantages for the apparatus include time saving, stock saving, and better cure information on a wider range of polymeric compounds than is obtainable from tensile test methods. In a laboratory where a large selection of test instruments is not feasible, the versatility of the apparatus described should prove very advantageous.

3:20 p.m.—19. The Vulcanization and Properties of Blends of Chlorobutyl with Other Rubbers. F.P. Ford, J. T. Kehn, and **G. J. Ziarnik,** Esso Research.

The results of studies on vulcanization systems for blends of chlorobutyl rubber (MD-551) and other elastomers are reported in this paper. The development and approaching commercial production of this new material make both possible and practical the use of polymer blending techniques to improve product quality, compound processing, or cost, wherein one of the polymers has the characteristic properties of butyl rubber.

Properties are a function of the curative system employed, which system, in turn, is related to the relative proportions and to the nature of the other elastomer in the blend. Medium-speed, di-ortho-tolylguanidine (DOTG), or delayed-action, 2-mercaptothiazoline (2-MT), accelerators, and sulfur donors have in general been found to be effective components of curative systems for blends of MD-551 with highly unsaturated elastomers.

In discussion of effects of vulcanization systems, major emphasis is given to chlorobutyl-natural rubber blends, but the vulcanization and properties of blends with neoprene, SBR, nitrile rubber, polybutadiene, and whole-tire reclaimed rubber are also described. By use of covulcanization techniques it is now possible to obtain butyl-type properties in wider areas of applications, for example, applications where some degree of oil resistance or enhanced low-temperature properties are required.

3:45 p.m.—20. Cross-Linking Efficiency of Dicumyl Peroxide. M. L. Studebaker and L. G. Nabors, Phillips Chemical Co., Akron.

At the Buffalo, N. Y., meeting of the Division of Rubber Chemistry, ACS, May 4-6, 1960, C. R. Parks and O. Lorenz reported on the use of model systems to study the cross-linking efficiency of dicumyl peroxide. In this paper we will present a similar study on gum and carbon black-loaded SBR 1500 and natural rubber.

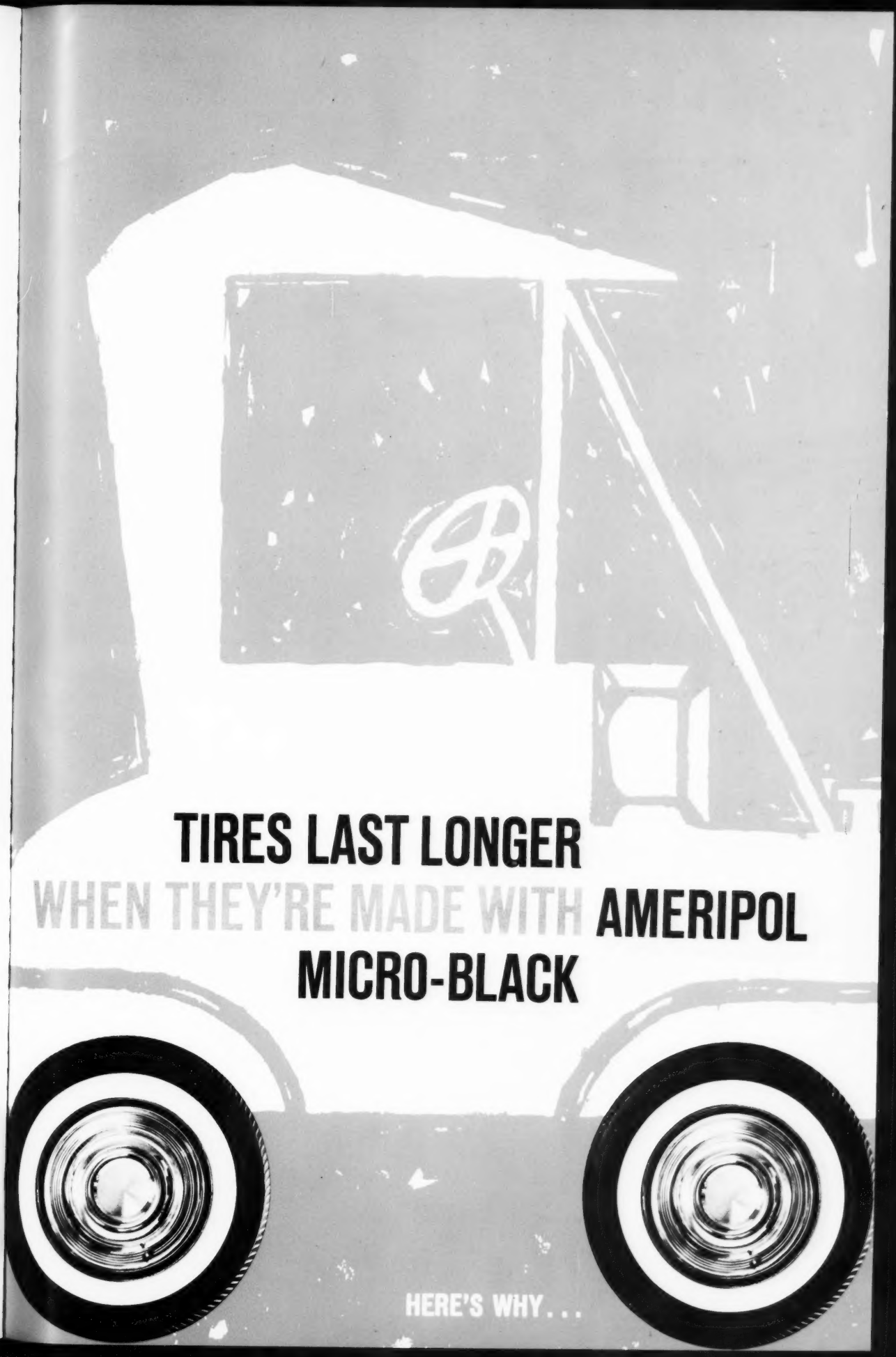
4:05 p.m.—21. Use of Selenium and Selenium Compounds in Rubber Compounding. W. J. Mueller and S. Palinchak, Battelle Memorial Institute, Columbus, O.

This study was undertaken to investigate possible new uses for selenium and selenium compounds in rubber compounding. During the work, selenium compounds were considered as (1) cross-linking agents, (2) accelerator-antioxidant combinations, and (3) antirads.

It was found that powdered selenium was an effective cross-linking agent in SBR, butyl, chlorosulfonated polyethylene, and acrylate polymers. Replacement of sulfur with selenium as the cross-linking agent improved the retention of physical properties on aging. The choice of accelerator used with selenium was important in order to avoid undercures. With butyl rubber, the aging properties obtained with selenium cures were better than with sulfur cures, but poorer than with phenolic resin-type cures.

Dibenzylselenourea and bis(2-hydroxy-1-naphthyl) selenide were found to be effective as combination accelerator-antioxidants. Each of the selenium compounds was almost as effective as a combination of phenyl-beta-naphthylamine and benzothiazyl disulfide. Several selenium compounds had antirad properties, but were no more effective than PBNA.

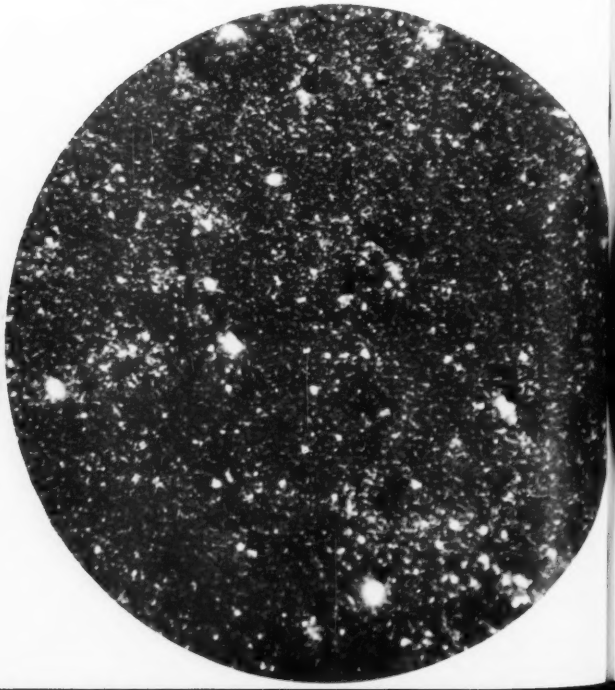
These results indicate that selenium or selenium compounds can be used to increase the heat resistance of several polymers. This behavior should permit the use of these polymers at


TIRES LAST LONGER
WHEN THEY'RE MADE WITH AMERIPOL
MICRO-BLACK
HERE'S WHY...

BETTER CARBON BLACK DISPERSION, MORE ABRASION RESISTANCE WITH AMERIPOL MICRO-BLACK

...THAT'S WHY TIRES LAST LONGER

Illustration 1—Photomicrograph below shows Ameripol 4659, a high dispersion Micro-Black containing 52 parts HAF carbon black. Note how thoroughly and uniformly the black is dispersed in the rubber.



Compare the uniformity of carbon black dispersion in Micro-Black (illustration 1, extreme left) with a counterpart formula, dry-mixed (illustration 2) and a slurry-mixed black masterbatch (illustration 3).

Micro-Black's micron-size particles are thoroughly dispersed in the rubber by an exclusive process—high liquid shear agitation at the latex stage. Result: tires and other products made with Micro-Black have controlled uniformity, superior dispersion, and greater abrasion resistance.

Photomicrographs shown here were made by Dr. Raymond P. Allen of Akron, Ohio, well-known Consultant in Industrial Microscopy. They are certified to be exactly as shown (100 times magnification) and unretouched.

CHOOSE AMERIPOL MICRO-BLACK FOR YOUR RECIPES AND YOU GET NOT ONLY A BETTER END PRODUCT, BUT ALSO:

Savings in time–Since the black is already in the rubber, you eliminate one weighing operation, one mixing operation, and shorten other mixing operations.

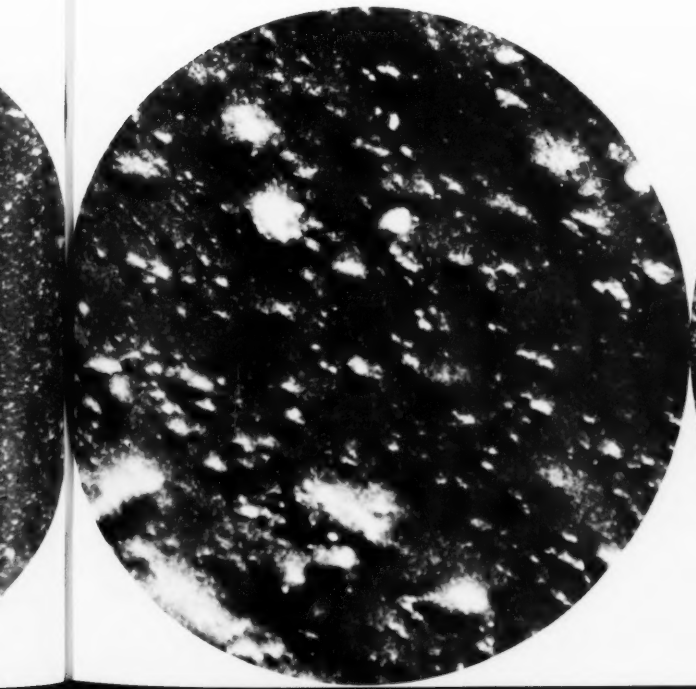
Savings in equipment–Elimination of the carbon mixing operation frees equipment for other uses and makes possible increased production without additional investment.

Savings in power–Fewer mixing operations, plus shorter mixing cycles, mean lower power consumption for the same volume of production.

Savings in inventory costs–You purchase and handle only one material–Micro-Black–instead of two–rubber and carbon black. And you need no extra storage space for carbon black, since it's already in the rubber.

Illustration 2—A conventional dry mix masterbatch containing 52 parts HAF carbon black.

Illustration 3—A black masterbatch containing 52 parts HAF carbon black, mixed by competitive slurry method.



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Whether you're making tires or any other rubber products, you'll find the right masterbatch to meet your requirements in the complete Micro-Black line.

COLD MICRO BLACK	BLACK		OIL		Emulsifier	Stabilizer
	Type	Parts	Type	Parts		
1605	FEF	50	–	–	FA	NS
4659	HAF	52	HA	10	RA	ST
4651	HAF	62.5	HP	12	RA	ST
4660	ISAF	52	HA	10	RA	ST

COLD, OIL MICRO-BLACK	BLACK		OIL		Emulsifier	Stabilizer
	Type	Parts	Type	Parts		
4760	SRF	75	N	17.5	MA	NS
4751	FEF	100	N	50	FA	NS
1805	HAF	75	N	37.5	FA	NS
4750	HAF	75	HA	37.5	MA	ST
4753	HAF	75	HA	50	MA	ST
4759	ISAF	75	A	37.5	MA	ST
4761	SAF	65	A	37.5	MA	ST

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THE ONE TO WATCH FOR NEW DEVELOPMENTS

higher operating temperatures than when sulfur cures are employed.

4:25 p.m.—22. Viscosity Changes in Rubber Solutions under Various Exposure Conditions. A. R. Kemp, The Los Angeles Rubber Group (Tlargi) Rubber Technology Foundation, University of Southern California, Los Angeles, Calif.

Little has been published regarding the changes taking place in rubber under normal laboratory handling in the course of fractionation, drying, solution, and standing in the dark or on the laboratory bench in light at room temperatures. This information is important in connection with research studies dealing with viscosity, osmotic pressure, and other measurements to characterize the hydrocarbon.

Phenyl-beta-naphthylamine and tetramethylthiuram disulfide have been added by some investigators to rubber solutions as stabilizers, but, no information as to their effectiveness has been presented.

This paper provides data on the effect of various antioxidants and other chemicals on the viscosity stability of rubber solutions where viscosity measurements are used as a very sensitive means of determining the changes in rubber under various conditions of exposure.

Natural rubber hydrocarbon is very stable in solution at room temperature in the dark with air over the solution, when prepared under suitable conditions. Short periods of light exposure on the laboratory bench bring about rapid oxidation scission of the rubber hydrocarbon in solution with resulting large decreases in viscosity.

A few chemicals such as some of the hydroxybenzene derivatives give some protection in the dark and light. No chemical, however, has been found to be very effective in the light. Most of the antioxidants and other chemicals have been found to be catalysts under both dark and light exposure. The natural rubber antioxidant is very effective in the dark, but offers only a small amount of protection in the light.

Friday Morning—September 16

8:00 a.m. Division Liaison Breakfast. W. S. Coe, presiding.

Technical Session—General Papers
E. H. Krismann, Presiding

9:30 a.m. — 23. Determination of Dynamic Properties of Elastomers by High-Speed Stress Relaxation. R. M. Cardillo and W. W. Gleason, Enjay Laboratories, Esso Research & Engineering Co.

Dynamic properties of elastomers can be measured over a broad range of frequencies, temperatures, and strain levels using short-time relaxation data on samples stressed at very high speeds. The data are expressed as dynamic modulus and loss modulus and represent results which would be extremely difficult to obtain in direct vibratory tests at the strain levels covered in these experiments (up to 450%). The data provide information sorely needed by design engineers working with shock absorption, vibration damping, and acoustical insulation problems.

Complex mechanical equipment and measuring devices are not needed since results are mathematically derived from a single high rate stress relaxation curve. Tests can be run in tension or compression, and degradations of samples by heat build up is not a problem.

The high-rate stress relaxation technique has been used to determine the frequency response of butyl and natural rubbers, characterizing the dynamic behavior of these materials up to 10^6 cps. These results supply detailed information on high-frequency response at high strain levels. Tests were run from —40 to 75° C. The data show the butyl rubber possesses high hysteresis in the intermediate frequency ranges; whereas natural rubber does not develop large amounts of damping until very high frequencies are reached.

The technique can be further employed to study effects of compounding variables and molecular structures and to characterize the behavior of other elastomers.

9:50 a.m.—24. Selection of Mixing Equipment for Silicone Rubber Manufacture. A. O. Liermann and D. E. Miller, General Electric Co., silicone products department, Waterford, N. Y.

The criteria for the comparison of the mixing of silicone rubber on two-roll mills or in internal mixers are presented in this paper.

The advantages and disadvantages of both types of equipment are discussed, including such factors as safety, product uniformity and output, flexibility, materials handling, space requirements, and costs.

In addition, some of the peculiar design requirements for mills and internal mixers, when used for silicone rubber, are described.

10:10 a.m.—25. The Effective Utilization of Blowing Agents. I—A Series of 1,1′-Azobisformamides. H. A. Hill and H. R. Lasman, National Polychemicals, Inc., Wilmington, Mass.

Studies were made to broaden the range of usefulness of 1,1′-azobisformamide (ABFA), which had been considered unsuited for use as a blowing agent in rubber because of its high decomposition temperature (195° C.). Besides compounding studies in several elastomers and plastics, the method of preparing ABFA was investigated. Comparison showed that the activity of the product as a blowing agent for SBR varied with process conditions. An approximately quantitative measure of this activity is expressed in the designations Kempore 60, 100, 125, and 150 for the series of ABFA's.

In tabular and graphic forms, this paper presents data which show the performance of these blowing agents in systems based on SBR, butyl, and neoprene rubbers, NBR, polyvinyl chloride, and polyethylene. Factors influencing the expansion of the several systems are illustrated, particularly the non-linear relations between the amount of blowing agent used and the reduction in density obtained. The densities of four chemically identical compositions based on SBR were found to vary from 0.3 to 0.9. ABFA-polymer interaction is postulated for some vulcanized elastomers and is discussed in view of the known cross-linking action of other azo compounds.

Methods and insights are provided for control of cell structure, hardness, and density, which effect economies in use of this blowing agent, just as further work presently under way extends the scope of usefulness of several new blowing agents.

10:35 a.m.—26. Heat-Aging Behavior of Clay-Loaded Butyl Rubber Insulation. F. Rodriguez and C. C. Winding, Geer Rubber & Plastics Laboratory, Cornell University, Ithaca, N. Y.

Butyl rubber compounds loaded with calcined clay and vulcanized by a non-sulfur quinoid system have been favored for electrical insulation used under hot, moist conditions. Now it has been discovered that the addition of certain polyolefins to these compounds can extend their usefulness into a broader range of conditions without impairing electrical stability.

In the particular formulation investigated, stearic acid was found to be quite detrimental to heat stability. Elimination of stearic acid and addition of 10 or more parts of linear polyethylene or certain other polyolefins give compounds which increase in tensile strength on aging up to three weeks at 121° C., rather than losing strength. The added retention of tensile strength is also noted on aging in water at 90° C. up to three weeks. In addition, dielectric constant, power factor, and volume resistivity have been found to be very stable over a period of a year during which the samples were immersed in water at 90° C. Butyl rubber loaded with talc or a thermal black also responds as with clay to modification by polyolefins. On the other hand, butyl rubber reinforced with channel black or silica is not improved by polyolefin addition.

An improvement in tensile strength retention by clay-loaded butyl rubber insulation without sacrifice in electrical stability should give a useful engineering material new opportunities for service.

10:55 a.m.—27. New Compounds for Air Barriers in Tubeless Tires. J. V. Fusco, Enjay Chemical Co., Division of Humble Oil & Refining Co., Elizabeth, N. J., and R. H.

Dudley, Enjay Laboratories, Esso Research.

The air-holding and age-resisting properties of butyl rubber resulted in the wide acceptance of butyl rubber inner tubes in the postwar years. With the advent of the tubeless tire, it became desirable to find a butyl-type polymer having improved compatibility with other rubbers for use in the tire liner. Such an air barrier would be expected to minimize tread separation or blowouts resulting from air penetration into the carcass.

This paper presents data on the application of chlorobutyl rubber (MD-551), a new, chlorine-modified butyl rubber in tire inner liners. Chlorobutyl rubber has a molecular structure similar to that of butyl rubber; thus it has equally excellent air-holding and age-resisting properties. The allylic nature of the chlorine in the butyl molecule enhances the polymer's compatibility with unsaturated rubbers commonly used in tire carcasses. It also permits a wide variety of operable cure systems with improved adhesion to other rubbers. Di-o-tolylguanidine salt of dicatechol borate (Permalux), thiocarbanilide, 2-mercaptothiazoline, 2-mercaptoimidazoline (NA-22), and various organic acids or acid anhydrides are all effective accelerators for chlorobutyl rubber. An outstanding accelerator combination is a new low-cost system which consists of zinc oxide activated by a rosin acid.

Compounds with adhesion to a natural rubber carcass stock of 70-140 lbs./inch are possible. In factory built tires, such a compound gives adhesion to the carcass equivalent to an inner liner prepared from current, more permeable unsaturated polymers.

11:15 a.m.—28. Determination of Latex Particle Size Distributions by Fractional Creaming with Sodium Alginate. E. Schmidt and P. H. Biddison, Firestone Tire & Rubber Co., Akron.

A method has been developed for the determination of the mass-particle size distribution in latices, by fractional creaming with sodium alginate. This method is based on the observation that the size of creamed latex particles depends quantitatively on the prevailing concentration of sodium alginate, regardless of the nature of the latex.

A calibration curve indicating inverse proportionality between creaming agent concentration and size of particles creamed was prepared with the aid of the electron microscope. By the use of this calibration curve, particle size distributions of latices covering a range from 500 to 10,000 Angstrom units diameter can be determined with no equipment other than an analytical balance and a number of separatory funnels.

This method is particularly advantageous for analyzing latices of very wide particle size distributions, which, when examined with an electron microscope, would require the counting of a very large number of particles. Detailed procedures and applications of this method are described.

11:30 a.m.—29. The Automation of Goodrich Flexometer Testing. A. F. Cody, Enjay Laboratories.

The Goodrich flexometer has gained wide acceptance in the rubber industry as a tool for testing the compression fatigue characteristics of both natural and synthetic rubber vulcanizates. Comparative data obtained with this instrument are particularly useful in research and development work to assist in estimating the service quality of vulcanizates in various applications such as in tires.

As presently constituted, the test requires the full attention of a skilled operator for extended periods of time. The present work was undertaken to devise a means of releasing this operator for other duties during the conduct of the test. Satisfactory automation of this equipment has been accomplished by means of a special rebalancing mechanism together with suitable recording equipment to indicate temperature and compression changes throughout a test. These modifications have not influenced the basic characteristics and capabilities of the machine in any way. They do provide an increased utility for the equipment at moderate cost which would be expected to be of interest to a considerable segment of the rubber industry.

RABRM Symposium on Rubbers' Service Life

The Research Association of British Rubber Manufacturers, Shrewsbury, Shropshire, England, held a symposium on "Service Life of Rubbers," May 2 to 5, at Attington Park, near Shrewsbury, attended by representatives of member firms of RABRM. The object of the symposium was to define the present requirements for rubbers in various areas; to outline the present state of scientific knowledge in the study of the breakdown of rubbers, including how breakdown may be predicted from accelerated tests, e.g., by stress relaxation; and also to indicate the ways compounding may assist in minimizing breakdown. Several papers were presented.

W. F. Watson, director of research of RABRM, gave a paper entitled, "Cross-linking and Scission, and the Properties of Rubber Networks," introducing the proceedings and summarizing the various concepts and ideas which have to be considered in problems of rubber technology, especially in questions of service life of rubbers.

J. Scanlan, RABRM, discussed the "Scientific Interpretation of Aging Tests." These tests on rubber compounds are carried out with two different objectives: (1) to obtain indication of behavior of the compound in service tests approximating service conditions, but more convenient and reproducible, and (2) to investigate the fundamental physical and chemical changes occurring in vulcanizates during aging.

R. C. W. Moakes, also of RABRM, described the difference between the effects of light and ozone on the deterioration of rubbers, particularly the effects of sunlight on their compounds used for proofed goods, and went on to consider methods for the testing of rubbers for light and ozone resistance.

J. T. Watts, Imperial Chemical Industries, Ltd., gave a comprehensive paper, "Chemical Additives and Aging," in which the various types of aging were reviewed, and the effect of degradation of different compounding ingredients was discussed.

S. G. Fogg, British Rubber Producers' Research Association, dealt with "Compounding Natural Rubber for Improved Aging Resistance." He mentioned it is possible to apply the techniques effective in TMT sulfurless stocks to natural rubber vulcanizates cured with dicumyl peroxide, and that this type of vulcanizate is preferred where a high resistance to reversion and set is required, e.g., in steam hose.

J. R. Pyne, RABRM, covered somewhat the same ground as Fogg with regard to synthetic rubbers.

There also were informative discussions on: (1) the aging and temperature requirements for rubbers for use by the Armed Forces and road, rail, and air transport; (2) rubbers at high temperatures, particularly acrylate rubber, fluorinated rubber, and chlorosulfonated polyethylene; and (3) developments in improved aging resistant latex compounds.

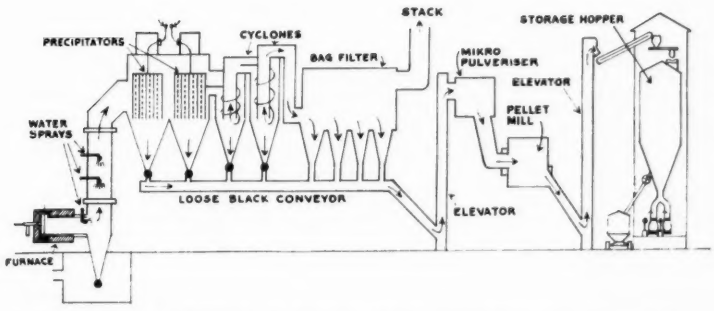
On the last day of the symposium the delegates saw demonstrations of aging and high-temperature test equipment at the RABRM laboratories.

Canadian Polymer Forum

The tenth Canadian High Polymer Forum will be held at the Alpine Inn, Ste. Marguerite, P.Q., Canada, on September 7-9. The Forum is sponsored by the National Research Council of Canada in cooperation with the Chemical Institute of Canada and is devoted to all aspects of polymer science.

The program includes the Forum lecture by Prof. F. S. Dainton and sessions on ionic polymerization, solution and solid properties of polymers, and light scattering. Further details on the program may be obtained from D. A. I. Goring, secretary-treasurer, Canadian High Polymer Forum, Pulp & Paper Research Institute, McGill University, Montreal, P.Q., Canada.

Oil Furnace Blacks Are Subject Of Connecticut Group Panel



Flow sheet for typical oil furnace black manufacturing operation

Carbon black, which has been in the news of the rubber industry quite a bit of late, was the subject of a panel discussion at the Connecticut Rubber Group spring meeting. This was held at Rapp's Paradise Inn, Ansonia, Conn., on May 20, with the panel following the cocktail hour and dinner.

The formal title of the symposium was "Oil Furnace Blacks," and the leading speaker, covering the same subject, was Isaac Drogin, United Carbon Co. The other three panel members, all from Godfrey L. Cabot Co., were: E. M. Dannenberg, discussing "General Properties of Oil Furnace Blacks"; T. D. Bolt, reporting on "Road Wear Performance of Oil Blacks"; and Harry J. Collyer, dealing with "Non-Tire Applications of Oil Furnace Blacks."

In his lead-off talk Dr. Drogin covered the oil furnace blacks, starting with the basic manufacture. He listed the six present manufacturers and the seventh who will join the ranks this year and the five well-established grades of furnace black that they produce. These five grades are SAF, ISAF, HAF, FEF, and FF. Noting that these are characterized by differences in particle size, processability, and extrusion performance, the speaker continued with some information on the recently introduced furnace blacks which match some of the properties of existing blacks, but do not fall completely in the ranges of the five grades listed above.

A discussion of the similarities and differences of the new blacks, as compared with the older grades, followed. The major reason for the new developments was given as the striving of the carbon black manufacturers to keep pace with the demands of tire manufacturers for carbon blacks which will better tire performance and also be in the proper range of economy.

The role of the latex black masterbatches was discussed. It was stated that the finer blacks require very thorough mixing with accompanying longer mixing times and danger of scorching. The addition of the black to the latex stage eliminates these troubles. The speaker suggested that latex masterbatches will play an even more important role in the future. Some information on the properties and applications of oil furnace blacks concluded Dr. Drogin's talk.

The second speaker, E. M. Dannenberg, changed the scope of his talk slightly from the original title. Scheduled to talk on "*General* properties of oil furnace blacks" he suggested that this was too broad a subject for one talk and would confine himself to a discussion of the one property having the greatest effect on modulus development in rubbers. The property of "structure."

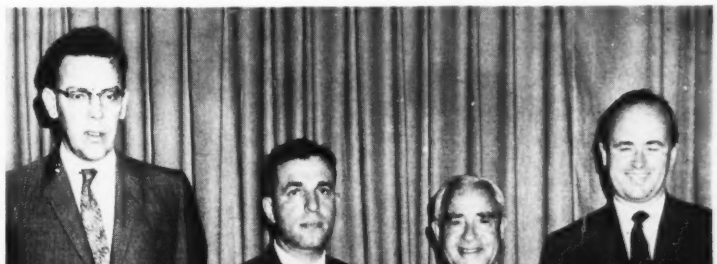
Modern oil furnace blacks, it was stated, generally give higher modulus than the older gas furnace black or channel blacks. They also differ in processing characteristics. He noted, however, that type of raw material; gas, oil type, and tars; are also instrumental in determining these properties along with the type of process. The structure of carbon blacks was defined as a permanent particle-to-particle association resulting in strong, fused, chemically bonded, chainlike aggregates. He used electron micrographs and oil absorption to show and measure structure. The use of compressibility as an indication of structure and the development of this test at Cabot were described as was the use of extrusion shrinkage measurements for the same purpose.

Thixotropic effects in rubber attributable to structure and the effect of structure on stress-strain properties were discussed in the concluding sections of the talk.

Road test performance, primarily of two of Cabot's new blacks, was described by Tom Bolt. The report covered several road tests: first, a comparison of Regal 300 with channel black in NR passenger treads; second, Regal 300 with channel black and HAF in NR truck treads; third, Regal 300 and Regal 600 with HAF and ISAF in SBR passenger treads.

Details and results of the tests were given. Conclusions drawn were that the Regal 300 was an adequate substitute for channel black, particularly where cutting and chipping might be a factor and that Regal 600 would be of use in producing an SBR passenger tread of low hardness, but with the wear resistance of an ISAF black. It was noted that a cure change was required for maximum development of properties in the Regal 300 series.

Non-tire applications of oil furnace blacks were covered by Harry J. Collyer. In fields other than tire compounding the speaker recommended Regal 300 as a replacement for channel blacks in those products where the higher modulus furnace blacks have proved objectionable. Plus features for



Connecticut Rubber Group panel on oil furnace carbon blacks consisted of T. D. Bolt, E. M. Dannenberg, I. Drogin, H. J. Collyer

the new black were given as lower cost, identical modulus and elongation as those of channel, closeness to EPC in tensile, requires less acceleration, and allowing a higher proportion of synthetic rubber.

Good results are expected for Regal 300 in butyl rubber and in NR particularly, but it may be used in all common elastomers. No mixing problems have been encountered in NR, CR, NBR, and oil-free SBR. Butyl and OE-SBR require careful attention to mixing as with EPC to insure good dispersion.

Similar results were shown for Regal 600, a low hardness replacement for ISAF, and for Regal SFR, an oil furnace replacement for gas SRF. A number of test situations and use suggestions were made for each of the three blacks.

PRG Hears L. M. White On Polymer Research

The spring technical meeting of the Philadelphia Rubber Group was held April 29 at the Poor Richard Club, Philadelphia, Pa., and honored the past chairmen. The speaker for the technical portion of the program was Leland M. White, United States Rubber Co., New York, N. Y., who discussed "Important Scientific Advance in Polymer Research." A cocktail hour and dinner preceded Dr. White's talk.

Dr. White discussed seven major achievements in polymer research which are helping the polymer industry grow at a rate of about 6% a year, or about twice that of the gross national product. In 1959, he said, American industry converted $2 billion worth of chemical raw materials into $4 billion worth of polymers such as synthetic rubber, fibers, and plastic resins, which in turn were converted into $13 billion worth of end-products.

The first major achievement in polymer research mentioned was the replacement of sulfur as a cross-linking agent by the ether cross-link for neoprene, the nitrone (quinone dioxime) cross-link for butyl rubber, the chromane (polymethylol phenol) cross-link for butyl rubber, and the carbon-to-carbon cross-link formed by the use of peroxide curing agents.

The second research achievement is the solution of the riddle of reinforcement of high polymers with fillers, which requires fillers of extremely fine particle size and the existence of very strong primary or secondary bonds between polymer molecules and filler particles. Chemicals are being found that will form a bond between the polymer and the filler particle without unwanted destructive side reactions leading to chain scission and gelling of the polymer molecules.

Graft polymerization is the third research achievement, and it was explained that this is a two-step process involving the production of precursors and then the reaction or polymerization with polymer radicals of the olefinic monomers.

Atomic radiation of polymer molecules is the fourth research area and has provided means of abstracting hydrogen radicals from the polymer chain to form polymerization sites on which olefinic monomers can polymerize to form a wide variety of new and useful materials. Atomic radiation can also form cross-links with polymers as well as form a chemical bond between polymer molecules and filler particles to provide reinforcement.

The fifth research achievement is the use of larger polymer molecules such as those employed with oil-extended styrene-butadiene rubber. The advantages of the use of these larger SBR molecules was explained both from a technological and an economic viewpoint.

The sixth area of achievement is stereoregular polymerization which has made possible the production of more crystalline polymers out of olefins and diolefins, has added new chemicals to the monomer roster, has made some polymerizations such as ethylene much easier, and has permitted the synthesis of several isomeric structures from a given monomer, thus providing a means of relating polymer properties with polymer structure.

The seventh and last major area of research achievement is the productivity improvement in growing natural rubber, which in the last 50 years has resulted in a sixfold increase in the yields per acre from commercial rubber plantations. These results were obtained by the use of nitrogen fertilizers introduced about 1920, the introduction of budgrafting and genetic selection about 1930, the use of more complete fertilizers introduced after World War II, and the current use of organic stimulants or plant hormones.

In summary, Dr. White emphasized that through these achievements in polymer research we are getting major cost savings through improvement in natural rubber productivity and the utilization of larger synthetic molecules, we are making significant quality improvements by new cross-linking methods and better utilization of fillers for reinforcement, and we are obtaining a host of new and useful materials from stereoregular polymerization, atomic radiation and graft polymerization.

B. U. Duvall at Thiokol Club

Record Attendance at Thiokol Technical Club

The dinner-meeting of the Thiokol Technical Club held at the Thiokol Chemical Corp. laboratories, Trenton, N. J., on May 24 attracted a record crowd of nearly 300 to hear B. U. Duvall, of the ORD Laboratories of the U. S. Army Corps of Engineers, who spoke on the use of polymeric systems in sealants for Portland cement concrete and also for remedial work on Portland cement concrete.

Mr. Duvall pointed out that the U. S. Air Force owns about 500 million square yards of concrete pavement at its various installations around the world, and that concrete is not a permanent pavement, but must be maintained. He said that epoxy resins systems are effective for sealant and repair use for concrete, but work best when modified by elastomeric materials such as polysulfide liquid polymers.

Many applications of these epoxy resin-polysulfide liquid polymer sealants were explained and illustrated by the speaker, and it was explained that they were useful not only for bonding old concrete to old concrete, but also for bonding fresh, wet concrete to old, cured concrete. As a mortar (when mixed with sand), these materials are very useful for repairing holes in pavements in a much more satisfactory manner than either complete replacement of a concrete slab or patching with various types of asphaltic-type materials.

Mr. Duval revealed also a new approach to dealing with the use of epoxy-liquid polymer sealants in that the polariscope can be used to follow the effects of aging.

Mann Replaces Brass on RW Editorial Board

James U. Mann, research scientist, at the United States Rubber Co. Research Center, Wayne, N. J., has replaced P. D. Brass on RUBBER WORLD's Editorial

Advisory Board. Dr. Brass resigned from the Board when his duties took him out of the country.

Mr. Mann received his B.S. in Ch.E. from Lafayette College in 1934 and that same year joined U. S. Rubber in its research and development department. Between 1934 and 1947 he worked on latex processing in the fields of dipping, spreading, and foam rubber. From 1947 to date his work has been related to the field of emulsion polymerization and the use of natural and synthetic latices in many fields. Mr. Mann will advise the editors of RUBBER WORLD in connection with latex technology.

The new Board member has been a member of the American Chemical Society and its Division of Rubber Chemistry and is active in local civic and social organizations in the Hopatcong, N. J., area where he resides.

James U. Mann

WRG Election

The Washington Rubber Group held its annual business meeting May 20 in the Pepco auditorium, Washington, D. C. Sound movies of subjects relating to rubber, plastics, and missiles were shown following the dinner and election of officers.

Newly elected officers who will take office in October are: president, Philip Mitton, Engineering Research & Development Laboratories, Fort Belvoir; vice president, George Flanagan, B. F. Goodrich Chemical Co.; secretary, Dan Pratt, U. S. Navy, Bureau of Ships; and treasurer, George Richey, National Bureau of Standards.

New Washington Rubber Group Officers *(left to right) seated,* George Flanagan and Philip Mitton, *standing,* G. Richey, D. Pratt

Ontario Group Dances

The Ontario Rubber Group held a successful Ladies' Night for members and guests at the Kress Hotel, Preston, Ont., Canada, June 17. About 75 couples enjoyed the evening's dancing, followed by a buffet supper and drawings for door prizes. A large number of members from Toronto was present, and a good representation came from the Hamilton and Kitchener areas.

Summer Outings

Fort Wayne

The Fort Wayne Rubber & Plastics Group held its ninth annual golf outing at the Tippecanoe Country Club, Leesburg, Ind., June 10. Quite a few competed in the golf tourney; others played horseshoes, baseball, and cards.

Only business of the day was the announcement of new officers who would take office the following day (June 11). New president of the group is Allen Bluestein, Anaconda Wire & Cable Co.; vice president, A. L. Robinson, Harwick Standard Chemical Co.; secretary-treasurer, Carroll Voss, General Tire & Rubber Co. The new directors are: (manufacturers) Bal Connell, General Tire; Jack Lippincott, Dryden Rubber Division; (suppliers) Al Cobbe, Godfrey L. Cabot, Inc.; and Jerry Zwick, Goodyear Tire & Rubber Co.

The 370 attendees enjoyed a smorgasbord and shared in a drawing for many door prizes.

A few of the many prizes awarded for the golf tournament included: for low gross, Don Zimmerman, U. S. Rubber; long drive, Richard Rieger, Union Carbide Plastics Co.; closest to pin, Robert Shewchek, General Tire; and fewest putts, John Lawless, Du Pont.

New York

A special feature of the New York Rubber Group summer outing this year was an enneathlon contest. With many of the events attracting as many as 138 entrants, 12 members scored 30 points or more in the contests. Grand prize winner, who will receive two tickets to Bermuda, was Joe Brandi, Cooke Color & Chemical Co., with a score of 37. Runner-up was Bill Lamela, perennial quoit champion from Okonite Co., with a score of 35. The nine events of the contest were: ball in barrel, hit the bottles, bocci, quoits, golf chipping, basketball throw, fly casting, dart throwing, and egg throwing.

The outing, held at Doerr's Grove on June 9, also included the customary softball games, afternoon food and drink, and dinner, with weather and good spirits combining to make a very successful day. B. C. Ross, Pennsalt Chemicals Corp., was the general chairman for the affair.

Boston

The twenty-fourth annual golf and recreational outing of the Boston Rubber Group was held Friday, June 17, at the Andover, Mass., Country Club. Total attendance hit 640, with 260 trying their luck on the golf course. Other events included softball game, darts, horseshoes, putting contest, horse racing, and tub and ball game as well as the wind-up lobster dinner.

A few of the 18-hole tournament winners included A. Nelson, B. F. Goodrich Footwear & Flooring, who had low gross; P. Jamieson, Macalaster-Bicknell Co., with low net; W. Platt, Columbia-Southern Chemical Co., took kicker's handicap; and Philip Blanchard, Blanchard Chemical Co., came closest to the pin. At the other end of the scoring picture, B. Blagman, Malden Mills, had high gross, and A. Grindle, Compo Shoe Co., had high net.

In the nine-hole tournament C. K. Mullen, C. K. Mullen Co., had low gross; Arthur Ross, American Biltrite Rubber Co., had low net; and E. A. Benchley, Angier Adhesives, took kicker's handicap. High side scores saw D. Snow, Goodrich Footwear, with high gross, and G. Covington, Phillips Chemical Co., with high net.

Winners of other events were: darts, A. Davis, Columbian Carbon Co.; tub and ball game, R. O'Brien, Goodall-Sanford Co. (Burlington); putting contest, H. Kitchens, Sessions-Gifford, Inc.; and horseshoes, team of Philip Blanchard and J. C. Cameron, Goodyear Footwear.

The committee under George Hunt, Simplex Wire & Cable, as chairman

included Robert Loveland, R. T. Vanderbilt Co. and Harry A. Atwater, Malrex Chemical Co. The committee reports that this was the largest outing in the Group's 24-year history.

Rhode Island

The same fine weather extended to Rhode Island on the ninth of June for the summer golf outing of the Rhode Island Rubber Club. United Carbon's terror of the fairways, Dick Stimets, was low gross winner and was closest to pin on the 7th. Second low gross went to William Stone, Kleistone Rubber, and third low gross to Lyle Longworth, Monsanto Chemical. Low net was taken by Robert Lovezzola, Raw Materials, Inc. William Locklin, Industrial Specialties, came nearest to pin on the 15th. High gross was awarded to William Glenn, Chemical Products Co., and high net to Rupert Bright, Dow Corning Corp. Putting contest winners were: first, William Maguire, United Carbon Co.; second, Stanley Szulik, Acushnet Process Co.; and third, Richard Murphy, Pittsburgh Chemical.

An informal luncheon and evening dinner completed the day's outing. J. Vitale, Crescent Co., was chairman of the outing, with P. Hastings, Kleistone Rubber, and W. Blecharczyk, Davol Rubber, as assistant chairman. Other committeemen included J. M. Donahue, Goodyear Chemical; C. A. Damicone, Acushnet, E. C. Uhlig, U. S. Rubber.

Committee D-11 Assigns Five New SBR Numbers

DESCRIPTION OF TYPES OF STYRENE-BUTADIENE (SBR) ELASTOMERS—ASSIGNMENT OF NEW CODE NUMBERS—ASTM D-11 1419-56T

Number as assigned	1608	1811	1813	1814	1815
Date assigned	5/31/60	5/31/60	5/31/60	5/31/60	5/31/60
Distinctive feature	ISAF black —Dispersant-free—low oil	SRF black —Dispersant-free—low oil	ISAF black —Dispersant-free—medium oil	ISAF black —Dispersant-free—high oil	HAF black —Dispersant-free—high oil
Close previous number, if any	Carbomix 3752	Carbomix 3756	Carbomix 3753	Carbomix 3758	Carbomix 3760
Type	1600	1800	1800	1800	1800
Nominal temp., ° F.	43	43	43	43	43
Activator	FRA	FRA	FRA	FRA	FRA
Shortstop	ND	ND	ND	ND	ND
Catalyst	OHP	OHP	OHP	OHP	OHP
Antioxidant	ST	ST	ST	ST	NST
Emulsifier	RA	RA	Mixed	Mixed	Mixed
Nominal bound styrene, %	23.5	23.5	23.5	23.5	23.5
Conversion, %	60	60	60	60	60
Mooney viscosity, ML 1-4 (212° F. —compound)	58	46	62	60	45
Coagulation	Acid	Acid	Acid	Acid	Acid
Carbon black type	ISAF	SRF	ISAF	ISAF	HAF
Phr.	52	75	60	75	75
Oil-type	HI-AR	HI-AR	HI-AR	HI-AR	NAPH
Phr.	12.5	17.5	37.5	50	50
Finishing	Normal	Normal	Normal	Normal	Normal

Note: Abbreviations and symbols are defined as follows:
FRA = free radical type, i.e., iron-pyrophosphate, peroxamine sulfoxylate.
ISAF = intermediate super abrasion furnace.
HI-AR = highly aromatic.
OHP = organic hydroperoxide.
ND = non-discoloring.
NST = non-staining.
NAPH = naphthenic.
ST = staining.
SRF = super reinforcing furnace.
HAF = high abrasion furnace.
RA = rosin acid.

Committee D-11 on Rubber and Rubber-Like Materials of the American Society for Testing Materials through Subcommittee 13 on Synthetic Elastomers of D-11 has assigned numbers to new styrene - butadiene elastomers, 1608, 1811, 1813, 1814, and 1815, all five requested by Copolymer Rubber & Chemical Corp.

An impromptu jam session including Frank Smith *(left)*, Naugatuck Chemical, along with bandleader Sal Libro (with clarinet) was an added feature of a very successful dance held by the Connecticut Rubber Group at the Sanford Barn, Hamden, Conn., on April 30. Another specialty, in addition to the dinner and suppliers' cocktail hour, was an "Andrew Sisters" quartet made up of Mrs. Francis Browning (Cabot) *(left in picture)* and Mrs. Smith *(right)* with Mrs. Peter Virtue (Cabot) and Mrs. Frank Magno (Cabot) not shown

Record Synthetic Latex Cargo Sent Via Seaway

A cargo of 340 long tons of Goodyear Pliolite 5352, the largest synthetic rubber latex shipment ever sent from a Great Lakes port through the St. Lawrence Seaway for an overseas destination, left for England on June 19.

Pliolite 5352 is produced by Goodyear Tire & Rubber Co., Akron, O., to act as a total replacement for natural rubber latex in foam rubber. According to Goodyear, the synthetic material has had good acceptance among foreign manufacturers who have traditionally used more natural than synthetic rubber.

From the Akron synthetic plant the latex was transported to the riverfront terminal at Cleveland, O., in 10 railroad tank cars, each of which had a 10,000-gallon capacity. At dockside, approximately 100,000 gallons of the latex were pumped into the British flagship, *Manchester Pioneer*, enlarged last fall to take advantage of increasing trade through the Seaway.

Goodyear began exporting synthetic latex through the St. Lawrence Seaway last August, with a shipment of a 9,000-gallon bulk cargo to England.

It was expected that the trip to Swansea, England, would take from 14 to 17 days for the freighter.

washington report

By JOHN F. KING

Federal Judge Rules That General Tire Is Entitled To OE-SBR Tread Patent

A Federal District Judge has ruled that General Tire & Rubber Co. is entitled to a United States patent for its oil-extended synthetic rubber composition widely used for making tire treads. The decision by Federal Judge Alexander Holtzoff on June 9 caps a nine-year campaign by General and three of its research scientists for exclusive rights on the immensely valuable patent which could affect every tire tread made today and for the next 17 years.

The Government's Patent Office and Justice Department which fought the company's claims ever since the Patent Office's Board of Appeals rejected General's patent application in 1957 have not indicated whether they will appeal Holtzoff's ruling. A decision on this is expected in July.

Product Patentable

The kernel of Holtzoff's ruling was that General's oil-extended process—in which large amounts of oil are added to tough, high Mooney synthetic rubber to produce a greater quantity of superior-type rubber—had "no element of novelty which justifies a patent . . ." But, he said, General and its scientists "achieved a novel product of a patentable character. . . .

"The manufacture of a new product does not necessarily depend upon the novelty of the process," Holtzoff explained. "It may result from an appropriate and new selection of the ingredients and their composition."

This argument answered the government's main defense of its rejection of General's patent bid—that there was "prior knowledge and use" of the oil-extended process. In the seven-day trial of the case which Holtzoff began June 1, Justice Department and Patent Office attorneys argued that the General process, developed by Gilbert Swart, E. S. Pfau, and Kermit Weinstock, was "nothing more than a utilization of pre-existing art and knowledge" whereby synthetic rubber plasticity was improved by large amounts of oil.

The government's defense claimed that the "generic idea" of oil-extended synthetic rubber was brought to this country from Austria in 1938 by Fritz Rostler, who distributed the invention, copublished at least one paper on it, and compiled a series of unpublished writings on the subject. The defense also brought out that there was a United Kingdom patent, the so-called Jennings patent, issued on the process in 1947. Finally, evidence submitted by the government on the very eve of the trial showed prior use of the process by the Wilmington Chemical Co., which with Dewey & Almy Corp. in 1942 and 1943 produced two batches of oil-extended synthetic rubber for the War Production Board which was similar to the General process.

Government Lax

Some of this testimony offered at the last minute was protested by General attorneys Edward B. Beal, of Washington, and Frank Earnheart, of Akron. Holtzoff agreed with them that the government was dragging its heels in proceeding with the case—he asserted at one point that "there's no doubt the government has been guilty of gross laxness in preparing for trial"—but ruled that "if there's some doubt on the plaintiff's (General's) claim, I wouldn't want to shut off the defense."

In his decision, Holtzoff recounted the history of efforts by Swart, Pfau, Weinstock, and General to patent their oil-extended composition, starting in November of 1950. In 1954 a Patent Office examiner allowed the patent, but two weeks later another examiner found "newly discovered references" to the process and asked for a withdrawal of the other examiner's ruling. The Patent Office agreed with the second examiner, and the General claim subsequently was rejected "on grounds that the claims were unpatentable over prior art . . ." The rejection was upheld in 1957 by the Board of Patent Appeals on "an item of prior art" which was a preexisting British patent which neither of the two examiners had considered. Holtzoff called this history "unusual."

In 1949, he continued, the three General scientists "discovered accidentally" that instead of destroying tough synthetic with large amounts of oil "they were producing a high-quality rubber suitable for tire treads." Holtzoff accepted the company's arguments that the three scientists had been experimenting with oil to find a cheap composition that could be used for automobile mats and other inferior products.

Holtzoff conceded that "prior art clearly indicates the use of oil in the processing of rubber for various purposes," as contended by the government. "However," he continued, "oil was generally used in small quantities rather than large quantites as is done by the inventors here. . . . (and) this discovery was not obvious in the light of prior art" and therefore is patentable.

Of the government's various counterclaims, Holtzoff said the British Jennings patent did not show the toughness or Mooney viscosity value of the rubber used, nor does it indicate that "superior" rubber is derived by the use of large quantities of oil, nor "that the process may be used for the purpose of augmenting the quantity of output as well as its quality."

The Wilmington Chemical-Dewey & Almy use of oil-extended rubber also did not show the Mooney value of the rubber involved, Holtzoff said. Noting that the government produced no witnesses to bolster this defense, the Judge said the Supreme Court has held many times that "the defense of invention by another must be established by the clearest proof, perhaps beyond a reasonable doubt."

In conclusion, Holtzoff held that while General and its scientists had not produced a novel, patentable process, they had achieved a novel product of patentable character. He therefore granted the plaintiffs more than 50 claims for the oil-extended synthetic rubber patent.

No Comment from General

General said in a press statement later that, of course, it was pleased with the Holtzoff ruling, but declined further comment until a detailed study of the opinion could be made.

Rubber Product Imports and Exports Discussed by Industry, Government

The rubber industry was talking with the government in June about two of its biggest worries: How to hold on to, and expand, its export markets, and how to protect itself from the flood of rubber footwear imports from the Orient.

In the first instance, discussing its export problems, the industry was talking with the Commerce Department, which currently is polling various United States industries on their difficulties in selling abroad. On the second point, representatives of the footwear segment of the industry talked their import problem over with the Senate Small Business Committee, the Tariff Commission, the State Department, and the Census Bureau.

Promotion of the rubber industry's $300-million-a-year export business was the subject of the Commerce Department's June 7 meeting on the general question of how to push U. S. industry into a more aggressive export program. The Department's goal is to ease the official restrictions against U. S. goods abroad in the hope that exports generally will rise and thus reduce the United States balance of payments deficit.

Commerce Blamed

Industry spokesmen at the meeting laid most of the blame for their export difficulties on the Commerce Department's export control system. They said the delay and bother of obtaining a license to export manufactured products and various types of synthetic rubber is "stifling" exports at a time when the industry is faced with the prospect of a rapidly rising productive capacity abroad. That capacity within the next year will be sufficient to meet foreign needs, they said.

Noting that U. S. exports of manufactured rubber products fell from $152 million in 1958 to $141 million in 1959, and that their $170-million foreign market for synthetic rubber is threatened by increasing capacity abroad, industry representatives said the government must reduce the export red tape if rubber exports are to survive, let alone grow.

"The only way we will be able to maintain our markets is by being aggressive salesmen and by giving our customers fast service," one industry spokesman at the meeting said. "We can't hope to give anybody fast service when we have to wait three weeks for approval of an export license."

In addition to this, the industry complained, is the added bother of obliging foreign customers to file lengthy statements with the U. S. Commerce Department attesting to the fact that none of the exported products will fall into Communist hands.

The Japan Rubber Mfrs.' Assn.

Shown above are some examples of rubber footwear being produced in Japan, some of which are being exported to the United States

The industry representatives said that while there may have been years ago a valid reason for placing synthetic rubber on the "positive list" of hypersensitive strategic materials, it no longer exists. They pointed out that foreign countries do not require export licenses for the products, and that if the U. S. Government does not change its policies, potential customers abroad will turn to other foreign sources.

Seek Tariff Changes

The industry spokesmen also urged the Department to recommend that at least half of all foreign aid funds spent in underdeveloped countries be channeled to U. S. suppliers. They also asked for official help in beating down the ocean shipping rates charged by U. S. steamship companies. Other requests made were that the U. S. should seek to bargain down Britain's imperial preference tariff which discriminates against U. S. rubber products; clarify the so-called Brussels nomenclature of international tariff terms; and induce Latin American nations to lower their high protective tariff walls against U. S. rubber goods.

Government officials said later they hoped some change in the protective policies of other countries of which the industry complained may be corrected as a result of this fall's negotiations with other member-nations of the General Agreement on Tariffs & Trade (GATT). Regarding the request for a "Buy-American" modification of U. S. aid policies, they said that probably nothing would or could be done to accommodate the industry. On the final point—the industry's complaint against U. S. export control regulations—Department officials said they would review the list of strategic goods which may not be exported without a lengthy licensing procedure to see if some of the red tape may be eliminated.

Footwear Imports Increasing

On the other side of the industry's foreign trade problem—the growing complaints about footwear imports—the rubber footwear division of The Rubber Manufacturers Association, Inc., sent its spokesman, Charles McFadden, to the Senate Small Business Committee to outline the "fantastic" surge in imports, particularly from Japan. The Committee, which cannot initiate legislation, held a one-day hearing on the impact of imports on small U. S. manufacturers.

Quoting reports from Tokyo, McFadden said that the Japanese Ministry of International Trade & Industry had set a U. S.-Canada export quota of 64 million pairs of rubber "zoris" (sandals) for the period June 6, 1960, to April 20, 1961. This total would be "many times the quantities of zoris ever imported," he said.

McFadden said his industry's immediate problem is the lack of specific statistics about the nature of the flood of imports, particularly a break-down showing the amount of zoris, rubber boots, overshoes, and various kinds of rubber shoes. This information now is being compiled by the Census Bureau and will be used to bolster the industry's case for import restrictions, which will be brought to the Tariff Commission as soon as the statistics are available. Industry spokesmen have been discussing the whole case with the Commission and the State Department, both of which have endorsed the idea of seeking import restrictions through the "escape clause" of the Trade Agreements Act.

In his presentation to the Small Business Committee, McFadden made it plain the rubber footwear producers are making common cause with the

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leather shoe manufacturers who also are bedeviled with import competition. The National Shoe Manufacturers Association, which also testified at the hearing, is seeking a strict import quota to limit foreign competition in the U. S.

New Stockpile Sales Plan Announced by GSA

The General Services Administration announced on June 23 a new program to make the sale of crude natural rubber from the stockpile competitive with freshly produced and imported crude natural rubber.

The agency said that approximately 70,000 long tons of rubber have been sold to date, leaving a balance of approximately 400,000 long tons remaining to be sold under the long-range disposal authorization. This provides for the sale of the amount available over a period of approximately nine years.

The announcement also said that while the quantities of each grade available for sale will vary from time to time owing to strategic and other reasons, present plans call for the sale of approximately 200,000 long tons of No. 3 Ribbed Smoked Sheets, 100,000 long tons of #2 RSS, 30,000 long tons of Pale Latex Crepes, and 70,000 long tons of #1 RSS.

The quantity of #1 RSS previously offered for sale on an optional basis of ⅞¢ off market price on an "as is" basis[1] had been reduced to about 20,000 long tons. In order to simplify the program this offer was withdrawn, and effective June 23, 1960, all ribbed smoked sheets will be sold on a guaranteed standard (with appropriate allowances for failure to meet the standard) in accordance with the following formula: (1) GSA to sell bareback ribbed smoked sheets at market price, less an allowance of ⅜¢ per pound to compensate for age, extra handling, thawing, etc., involved in the stockpiled rubber. (2) The buyer to have the right of inspection with (a) the cost of inspection to be payable by each party in accordance with present practice, (b) appropriate allowance will be granted by GSA for waiver of the right of inspection by the purchaser, and (c) all rubber to be weighed at GSA's expense, 10% net testing for uniform weight bales and 100% gross testing when bale weights are non-uniform. (3) GSA will entertain offers for ribbed smoked sheets, grades 1, 2, and 3 at market price for the month of delivery desired at the time of purchase, less the allowance of ⅜¢ per pound for age, thawing, and extra handling expense. GSA will have the option of delivering contract grade or a higher grade of ribbed smoked sheets. (4) GSA will publish quarterly the approximate quantity of each grade remaining available for sale. (5) The buyer will be required to furnish GSA with the destination to which the rubber is to be shipped at least two weeks prior to desired date of shipment.

[1] RUBBER WORLD, June, 1960, p.120

URW To Start Wage Talks

The United Rubber Workers Union, AFL-CIO, has served notice on reopening negotiations for a "general wage increase" with all of the Big Four rubber companies. Settlement of the negotiations will affect the wage structure for some 100,000 URW members throughout the entire rubber industry.

Wage talks will start with the Firestone Tire & Rubber Co. on July 18 in Cleveland. On July 26, bargaining teams from URW and the Goodyear Tire & Rubber Co. will similarly begin negotiations in Cleveland, and on the same date talks with the United States Rubber Co. will open in Cincinnati. URW has served notice also on The B. F. Goodrich Co., but starting date and site for the negotiations were not immediately selected.

Wages Only Issue

The wage reopener notices follow the signing just last spring of two-year contracts with the major rubber companies. These contracts provide that wage talks may be reopened at the Union's request at any time. It has been a custom in the industry to hold wage talks annually.

Last year, following lengthy strikes against Firestone, Goodrich, and U. S. Rubber, URW settled for a 10¢ hourly pay boost that was granted industry-wide. The long walkouts were occasioned, however, by disagreements over pensions, insurance, and basic working agreements, not wages. It is expected that, as in past years, URW's settlement with the Big Four will become the pattern for industry-wide wage settlements.

If this year's wage reopener settlement follows that of past years, the Union will not demand so much as it has on the negotiation of new Union contracts. New contract talks in 1953, 1955, and 1957 produced industry-wide raises of 12, 14, and 15¢ respectively. At the same time, when wages were "reopened" for negotiation under existing contracts in alternate years, the Union settled for 6.5, 6.2, and 8¢ an hour in 1954, 1956, and 1958.

Under the basic URW contract with the Big Four, if a wage settlement has not been reached within 60 days after the serving of a reopener notice, the Union is free to call a strike since its contract with the companies is cancelled. In the current issue, a strike could be called in mid-August if no agreement is reached.

The URW's demand for a "general wage increase" this year, decided at the May 27-28 meeting of the Union s international policy committee meeting in Chicago, does not detail what is wanted in dollars and cents. This demand will take shape during actual negotiations with the companies.

Possible Stumbling Blocks

Other planks in the Union's 1960 platform were the following, which may or may not become knotty issues in these company bargaining sessions:

(1) Additional wage increases to adjust inter-plant and intra-plant inequities wherever they may exist.

(2) Formulation of a relief program to aid workers affected by automation and to protect other workers against being similarly affected, "through the negotiation of contract provisions" and by political action.

(3) Intensification of URW's skilled trades program, including the negotiation in individual contracts of provisions which "prohibit work of a type normally performed by our members from being let to outside contractors."

(4) Supplementation of Workmen's Compensation Benefits, improvement of fringe benefits, and the strengthening of URW ties with Canadian affiliate unions.

DLF Loan to Yugoslavia

The U. S. Development Loan Fund (DLF) announced in June it is making one of its bigger loans to finance construction of a large plastics and chemicals plant in Yugoslavia. While details of the credit have yet to be negotiated, DLF will advance up to $23 million on loan repayable in Yugoslav currency to build a factory with eight processing units to produce up to 27,600 metric tons annually of polyethylene, styrene, polystyrene, phenol, and acetone.

These chemicals and plastics will fill Yugoslavia's need of plastic insulation material for such uses as electric insulation, housewares, pipes, dyes, resins, latex paints, synthetic tanning, nylon, varnish, adhesives, plastic films and sheets, and vitamins. The basic raw material for the factory will be liquefied petroleum gas.

Certain licenses, equipment, and engineering services worth an estimated additional $6.5 million will be financed by the United Kingdom and will be purchased with British financing from British firms. The $23 million DLF is pledging to the project will finance both U. S. engineering and the procurement of specific items of capital equipment in the U. S.

Also in June, the International Finance Corp., a multilateral financing agency, announced it was investing another $90,000 in Rubbertex, Ltd., an Australian rubber products firm. IFC's original investment in the company was $225,000.

industry news

Easier Processing Black Masterbatch

The first three SBR-carbon black masterbatches of a series were announced this month by United Carbon Co., New York, N. Y. While actual specifications of the three products, Baytown 8675, 8677, and 8775 are not yet available, they are understood to be non-dispersant-type masterbatches made by a new United-Barclay process using salt-free coagulation.

In making the announcement R. W. French, United Carbon president, indicated that the new process provides far more exact production control and thus puts out a product which is very highly uniform and therefore offers faster processing, outstanding handling ease, and increased tread wear in the resulting compound. Tests have indicated 10% higher tread wear ratings over conventional masterbatches on a one-pass mix.

Company spokesmen claim that the better processing characteristics are the major improvement obtained by the $1 million spent on equipment conversion and enlargement. The better tread wear alone had been realized with previous materials, but without the ease of handling and processing.

Primary credit for development of the new process was given to Gerald M. Barclay. Barclay, former engineer in the Baytown plant, is now assigned to process studies in the research and development department's pilot plant at Baytown. Pilot-plant studies of the process have been conducted for the past year with full-scale production runs being made during the past three months. Patents have been applied for on the brine-free coagulation step.

Gerald M. Barclay, developer of United Carbon's United - Barclay process for making the new dispersant- and salt-free SBR-carbon black masterbatches

The Baytown plant, opened by the government in 1944, has produced more than two billion pounds of black masterbatch and with the installation of planned new equipment will have an annual capacity of 200 million pounds.

Test programs on these first three members of the series which are designed for tread compound use have shown them to produce less residual nerve after Banbury mixing, thus giving the customer more uniform extrusions and, hence, less rejects. The process produces a low ash product insuring better aging and lower moisture absorption.

Additional masterbatches in this series will be announced shortly which will be designed for non-tire uses.

IRSG May Estimates of Rubber Supply and Demand Indicate 1960 NR Surplus

The management committee of the International Rubber Study Group, in a press communique issued during May, stated that it had examined the statistical position of rubber and made estimates for requirements and supply of natural and synthetic rubber during 1960. It was estimated that world production of natural rubber would be about 2,135,000 long tons, and with sales from government stockpiles in the United States, the United Kingdom, and Italy up to the end of April for delivery in 1960 to amount to some 95,000 long tons, this estimate brought the total new supply to 2,230,000 long tons. In addition, if the price of natural rubber remains somewhat above the level at which the United States and United Kingdom governments have stated that they are free to sell unrestricted quantities of rubber, the committee estimated that substantial sales will continue to be made, and that these might be in the order of a further 75,000 long tons for delivery during 1960.

ESTIMATED NATURAL AND SYNTHETIC RUBBER CONSUMPTION IN 1960

(In 1,000 Long Tons)

Territory	Natural	Synthetic	Total
United States of America	540	1,115	1,655
United Kingdom	170	100	270
Federal Republic of Germany	143	93	236
France	128	85	213
Japan	168	42	210
Canada	46	61	107
Italy	60	40	100
Australia	36	24	60
Czechoslovakia*	30	1	31
Netherlands	22	8	30
Belgium	15	11	26
Austria	11	10	21
Indonesia	15	—	15
Denmark	6	2	8
Hungary*	7	1	8
Federation of Malaya and Singapore	6	—	6
Thailand	1	—	1
Other member countries†	3	—	3
Other countries	703	157	860
TOTALS	2,110	1,750	3,860

World consumption of natural rubber, i.e., turn into manufactured goods, was estimated at 2,110,000 long tons, and thus for the first time in many years an excess of new supply over consumption of at least 120,000 long tons of natural rubber seemed possible. If the additional 75,000 tons were sold from the various government stockpiles, this surplus would rise to almost 200,000 long tons.

The committee added, however, that at the end of 1959, commercial stocks of natural rubber in both producing and consuming countries had reached an unusually low level, and that, in its opinion, a considerable part of what-

* Estimated imports from member countries.

† Belgian Congo, Burma, Cambodia, Ceylon, Liberia, and Viet-Nam.

ever surplus of natural rubber there may be in 1960 would be used to rebuild commercial stocks to a more normal level in both producing and consuming countries.

World production of synthetic rubber in member countries was estimated at about 1,810,000 long tons; while total synthetic rubber production capacity in member countries was assessed at 2,335,000 long tons. World consumption of synthetic rubber, apart from the synthetic rubber produced in non-member countries, was estimated at 1,750,000 long tons. The rate of consumption of synthetic rubber continues to increase and the difference between production and consumption of synthetic rubber is likely to be no more than will be required to build up working stocks, it was added. Synthetic rubber production in 1960 in the United States was estimated at 1,355,000 long tons, in Canada at 150,000 long tons, and in other member countries at 305,000 long tons.

The consumption of both natural and synthetic rubber on a worldwide basis in 1960 is estimated in the table on the preceding page.

Rex-Syn Cup Packing Material Introduced

A new compound for use in cup packings was introduced by E. F. Houghton & Co., Philadelphia, Pa. at the Design Engineering Show held in the New York Coliseum, May 23-26. While the actual composition of the new compound was not disclosed, it was described as a vulcanizing compound based on an NBR elastomer with a special phenolic resin as one component.

The new compound is named Rex-Syn, symbolizing the King of the Synthetics. It is claimed to be outstanding in such properties as high wear resistance, low friction, wide pH range, and high tensile strength at a low cost.

Using a Houghton developed Justice machine, a testing machine which magnifies the friction-building forces present in an operating hydraulic system, Rex-Syn cup packings proved to be less friction causing than any competitive cup including fabricated duck and synthetic rubber cups.

Other good properties, according to Houghton, are compatibility with fluids, little shrink or swell in ASTM oils, satisfactory performance from 0 to 212° F., and long storage life.

Although specifically introduced as cup packings, the company suggests that this material is a multi-purpose packing material for use where conditions require a long-lasting, hard-wearing packing at relatively low cost, and that it can be molded to any appropriate shape by normal rubber molding techniques.

A descriptive brochure is available from the company.

Harwick To Represent Alpine Aromatics

Harwick Standard Chemical Co., Akron, O., has been appointed a major distributor of Aldor deodorants and scents to the rubber and plastic industries, according to Raoul Pantaleoni, president of Alpine Aromatics, Inc., Metuchen, N. J. Harwick will handle all of the products offered by Alpine's industrial division.

With headquarters in Akron, O., and offices in Albertville, Ala., Boston, Mass., Chicago, Ill., Greenville, S. C., Los Angeles, Calif., and Trenton, N. J., Harwick will provide Alpine with excellent national industrial coverage.

According to Pantaleoni, the tremendous increase in the number of new resins and plastics has made it necessary to tailor-make deodorants and counteractants. This need requires on-the-spot representation backed up by a well-maintained central laboratory. There are always more than 20,000 different Aldor formulations. Specific scents such as talcum powder, cedar and leather, and non-descript odors are used with vinyl, polyethylene, styrene, and other permeable polymers. Aldor neutralizers are used to overcome objectionable monomer off-odors, residual blowing agents, or to impart a positive fragrance.

Polyethylene Use Up In Rubber Compounding

Use of low-molecular weight polyethylenes is growing rapidly in rubber compounding, according to Allied Chemical Co., New York, N. Y. The company reports that its A-C Polyethylenes are being used to improve processibility and to confer vulcanizate properties suitable for many types of rubber products.

Hatfield Wire & Cable Division of Continental Copper & Steel Industries, Hillside, N. J., recently used the polyethylenes in neoprene-jacketed lighting and power cables for Idlewild International Airport; New York City Department of Street Lighting; Candlestick Park, San Francisco, and the George Washington Bridge.

Before using A-C Polyethylene as a neoprene processing aid, Hatfield had problems with some neoprene batches sticking to mill rolls, delays in getting neoprene slabs to cooling chambers because of sticking which led to scorching, and rejections by quality control supervisors as a result of the sticking and the scorching. All three problems have been greatly reduced with the additions of the low molecular weight polyethylene. The company has minimized rejections with subsequent savings.

For general compounding purposes, from two to five parts are usually enough to provide a marked improvement in processing properties, although incorporation of as many as 10 to 100 parts of the different elastomers shows no evidence of blooming or migrating. Tack can be modified without adverse effects on adhesion of laminated and fabricated products.

Viscosities, scorch sensitivity, and shrinkage are decreased, dimensional stability is improved, and calendering and extruding rates are increased, it is further reported.

C. P. Hall Co. Chooses Officers

The C. P. Hall Co., Akron, O., has reorganized the officers following the death of the president, C. P. Hall. W. T. Hall is now president; C. R. Hall is vice president, research; and G. D. Scott is secretary-treasurer. Officers for the C. P. Hall Co. of Illinois are S. A. Davis, who is president; C. K. McMillen, vice president, treasurer; C. R. Hall, vice president of research; and W. T. Hall, secretary. The C. P. Hall Co. of California has named A. H. Federico president; W. T. Hall, secretary-treasurer; and J. T. Modawell, assistant secretary.

Canadian Group Elects Officers

The Rubber Association of Canada elected C. Evans Joslin, vice president and general manager of American Biltrite Rubber Co., Sherbrooke, P.Q., president of the Association, at the annual meeting held at the Royal York Hotel, Toronto, Ont. T. M. Mayberry, president of The Firestone Tire & Rubber Co. of Canada, Ltd., Hamilton, Ont., was chosen vice president, and W. H. Mason, president and general manager of Seiberling Rubber Co. of Canada, Toronto, treasurer.

In addition, the following were elected to the board of directors: J. P. Anderson, president and general manager, Dunlop Canada, Ltd., Toronto; M. F. Anderson, president, Dominion Rubber Co., Ltd., Montreal, P.Q.; R. H. Mallory, executive vice president, General Tire & Rubber Co. of Canada, Ltd., Leaside; J. W. H. Miner, vice president, Miner Rubber Co., Ltd., Granby, P.Q.; L. T. Rosser, president and general manager, Mansfield Rubber (Canada), Ltd., Barrie; L. E. Spencer, president and general manager, Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto; and R. V. Yohe, president, B. F. Goodrich Canada, Ltd., Kitchener.

The Hon. Robert H. Winters, president of Rio Tinto Mining Co. of Canada, spoke on "Developing Canada's Resources."

Enjay Splits U. S. in Three Sales Districts

Enjay Chemical Co., newest division of Humble Oil & Refining Co., New York, N. Y., recently divided the United States into three geographical sales areas—eastern, central, and western. Also, Enjay named C. J. G. Leesemann, former acting manager of chemical marketing operations for the Humble division, as manager of the new western division.

D. G. Burnell, who also served with the Humble division, has been named manager of the Houston district, a newly created sales district within the western division. Burnell's staff will include E. D. Shannon and O. B. Taylor, technical sales representatives, and J. R. Duffy, marketing assistant, all of whom were formerly with the Humble division.

The western division, with headquarters in Houston, Tex., will be responsible for marketing chemical products in Texas, Oklahoma, Arizona, New Mexico, Idaho, Utah, Nevada, California, Oregon and Washington. This territory includes the West Coast sales district, managed by F. B. Floren, of the company's Los Angeles office, and the Tulsa, Okla., office, headed by K. R. Costikyan, Jr.

Most of the new western division was formerly serviced by the newly defined central division, which has its headquarters in Chicago, Ill., and is managed by W. F. Wadt. The Akron, O., district, managed by J. L. Ernst and formerly part of the eastern division, will now be part of the central division.

New Firm To Make Polyurethane Foam

Robert W. Ward has been named president of the newly organized Olympic Chemical Co., Greensboro, N. C., producer of polyurethane foam for the furniture, textile, and rug industries. The announcement was made by Ceasar Cone, president of Cone Mills Corp., which has a major interest in the new firm. The plant is located in a modern building near several of Cone Mills' plants in Greensboro.

Other officers of Olympic are Sydney M. Cone, Jr., vice president; Harold W. Smith, secretary-treasurer, and Alan W. Cone, assistant secretary. Mr. Ward has announced the appointment of Lester W. Bates as plant manager. Between 25 and 30 people will be employed at the start of operations in July.

The new company's president, Ward, served as head of the engineering department of Nopco Chemical Co., Newark, N. J., until 1955, when he went to Germany to investigate the polyurethane industry. Upon his return he was made production manager of Nopco plastics division. Previously he was associated with American Cyanamid Co. and Reynolds Plastics Co.

The new plant manager, Bates, has been research supervisor for Hewitt-Robins, Inc., Franklin, N. J., for the past six years.

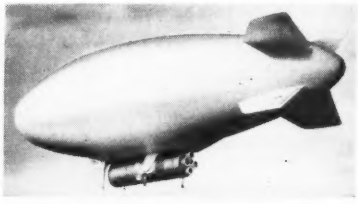
Latex Foam Rubber Use in Furniture

Latex foam rubber accounts for 79% of the cushioning material used by the upholstered furniture industry in the Northeast, according to a survey of manufacturers undertaken by the Latex Foam Rubber Council of The Rubber Manufacturers Association, Inc., New York, N. Y.

Results of the regional survey, based on a 38% response from the 161 upholstered furniture firms in New York, New Jersey, Pennsylvania, Connecticut, and Massachusetts with 20 or more workers, further disclosed that 21% of the respondent manufacturers employed latex foam exclusively for cushioning. Of the remainder 72% reported using latex foam cushioning for 50% or more of their entire production; while only 7% use less than 50%, stated Edward Welch, chairman of the Council.

Reasons cited by manufacturers for their preference for latex foam included luxurious comfort combined with great durability, more efficient manufacturing because of ease of fabrication, and virtually complaint-free performance.

By states, manufacturers in Pennsylvania place the greatest reliance on latex foam cushioning, with 92% usage. Connecticut makers are next with an 86 percentage.



Non-rigid airship has been proposed to transport heavy 40-ton rocket booster stages from factory to launch site. Goodyear Aircraft Corp., Akron, O., builder of lighter-than-air craft, reports that airships ranging in size from 1.5 million to 5 million cubic feet could haul present and future boosters without difficulty, requiring little ground handling and only limited runways. Flying non-stop at 70 knots speed, the booster-carrier could reach any U. S. base within 30 hours

New Humble Building Protected by Butyl

The new 44-story Humble Oil & Refining Co. building, scheduled for completion in Houston, Tex., in 1962, will stand on a black carpet of butyl rubber. Almost 60 feet below the ground's surface, workers recently began rolling out butyl sheeting which will serve as a water barrier for the foundation of the building.

The rubber is produced at Humble's Baytown, Tex., and Baton Rouge, La., refineries and is marketed by Enjay Chemical Co., a division of Humble. The rubber is processed into the long waterproofing sheets, ⅛-inch thick by other manufacturing firms.

In the excavation site, the sheeting is placed on a thin concrete slab. A seven-foot-thick steel-reinforced concrete slab will be laid on the butyl cushion. The sides of this foundation and the retaining walls above also will be encased by the membrane. Eventually, some 230,000 square feet of the sheeting—weighing more than 200,000 pounds—will be used in the construction of the office building and an adjacent garage.

This exterior application of the butyl is less costly than most conventional methods of creating a water barrier, reports Humble. Butyl was selected also because of its durability, toughness, and water impermeability. The foundation of the building is being constructed in an area of water-bearing sands, where the permanent water table is only 18 feet below the surface.

CHR Buys West Coast Rubber Goods Firm

The Connecticut Hard Rubber Co., New Haven, Conn., has completed arrangements to buy the assets of California Rubber Products, Inc., Torrance, Calif., for an undisclosed amount. The 20-year old California producer of ducts for the aircraft industry will be operated as a separate division of CHR. The company's present management will be retained.

A CHR spokesman said that the acquisition will enable his company to broaden its line of products to the aircraft industry. In addition, the California division will provide an outlet for some semi-finished products from CHR.

William E. Shawger has been president of the West Coast firm for the past 16 years. About 40 people are presently employed by the firm in a modern 22,000-square-foot building in Torrance.

The Connecticut Hard Rubber Co., founded in 1921, is one of the leading fabricators of silicone rubber airframe seals, coated fabrics and tapes. CHR, employing more than 300 persons in two plants at New Haven, maintains sales offices in Los Angeles, Seattle, St. Louis, and Atlanta.

news briefs

TEXAS-U.S. CHEMICAL CO. has moved its New York sales office to 9 Rockefeller Plaza, New York, N. Y., from the former spot at 260 Madison Ave.

POLYVINYL CHEMICALS, INC., Peabody, Mass., has completed new production facilities which will boost its emulsion polymer capacity by 20 million pounds annually. The new units will initially produce styrene, acrylic, and vinyl acetate polymer emulsions and can be adapted to produce a variety of other polymer materials. Additional research and pilot-plant expansions will provide the company means for further broadening its search for new materials for surface coatings.

B. F. GOODRICH CANADA, LTD., Kitchener, Ont., Canada, plans to expand its plant at Welland, Ont., to increase its capacity by at least 25%. Construction of the $100,000 project will begin soon.

M. L. SNYDER & SON, INC., Philadelphia, Pa., manufacturer of rubber goods, fire equipment, and waterproof clothing, reports that it is now manufacturing sponge-rubber drum gaskets at its plant in Woodbridge, Ont., Canada. Other products made at Woodbridge include industrial gloves and aprons, protective clothing, rubber balloons, etc. W. C. Smith is the Canadian branch manager; he joined the firm in 1940.

CANADIAN INDUSTRIES, LTD., is building a plant at its Hamilton, Ont., Canada, works to enter into the manufacture of organic chemical specialty products with the production of stabilized dinitroso pentamethylene tetramine, a blowing agent for certain types of cellular foamed rubber. Until now the company has imported and sold the product under the trade name, "Vulcacel" BN, which will be retained. The plant will be stainless steel throughout to prevent possible contamination through corrosion.

THE B. F. GOODRICH CO., Akron, O., has awarded the first construction contract for the new tire plant at Fort Wayne, Ind., to MacDonald Construction Co., St. Louis, Mo. The contract covers site preparation work for the project. The first phase should be completed by October 1.

This tag design has been adopted by member companies of The Latex Foam Rubber Council of The Rubber Manufacturers Association, Inc., for point-of-sale identification of all latex foam rubber used in upholstered furniture, bedding, pillows, and other items of home or office furnishings. Likewise projecting the quality image of latex foam, replicas of the symbol will be carried in member firms' latex foam print advertising, expected to aggregate $900,000 for 1960

H. MUEHLSTEIN & CO., INC., New York, N. Y., has combined its rubber and plastic divisions at Chicago, Ill. The new address is 221 N. La Salle St.

TRELLEBORG RUBBER CO., LTD., with head office in Montreal, P.Q., Canada, has been granted letters patent as a private company, with an authorized capital of 1,000 common shares of $25.00 par value. The company will possibly be a subsidiary of Trelleborg's Gummifabriks Aktiebolog, Trelleborg, Sweden.

PARAMOUNT FOAM INDUSTRIES has moved from Ridgefield, N. J., to Mercer and Arnot Sts., Lodi, N. J. The move was necessitated by the firm's desire to expand in the polyether polyurethane field. The firm previously had been furnishing only a polyester-based polyurethane called Flexifoam. The new factory comprises about 100,000 square feet on one floor, with railroad siding.

CARY CHEMICALS, INC., reports that effective June 15 its new mailing address will be P. O. Box 38, East Brunswick, N. J. The new telephone number is CLifford 7-7000. The company's shipping address remains the same: Cary Chemicals, Inc., Ryders Lane, East Brunswick, N. J.

PENNSALT CHEMICALS CORP., Philadelphia, Pa., has started another expansion of its organic sulfur chemicals facility at Houston, Tex. Expected to cost more than $750,000, the new production unit will use a portion of the expanded capacity for hydrogen sulfide which was installed this spring. The latest unit, which will produce a variety of alkyl mercaptans, was planned as an integral part of the overall expansion at Pennsalt's Greens Bayou plant. Completion is scheduled for early in 1961. Uses for these materials include the manufacture of synthetic rubbers and plastics.

STILLMAN RUBBER CO., Culver City, Calif., is offering a new line of silicone O-rings based on a special formulation, TH-1057. These new O-rings have been developed to seal difficult fluids and are highly resistant to swelling normally caused by solvents, jet fuels, and oils. O-rings made from TH-1057 provide an excellent seal for fluids in the low temperatures to 450° F. and above. Application data and additional information are available from the company.

GENERAL ELECTRIC CO., silicone products department, Waterford, N. Y., has reduced the price of silicone fluid and emulsion products, for the second time in 10 months. The 4% cut took effect June 1.

POLYMER CORP., LTD., Sarnia, Ont., Canada, has agreed to give technical assistance and advice to Petroleos Mexicanos for the design and construction of a plant in Mexico to produce general-purpose copolymer rubber. Polymer will also give technical and production training, at Sarnia, to some employes of the Mexican firm and will assist in start-up operations at the Mexican plant.

FLINTKOTE CO., New York, N. Y., is starting a floor tile plant in British Columbia to complement a similar plant in Toronto, Ont., Canada.

news briefs

TEXAS-U. S. CHEMICAL CO. has moved its Atlantic district sales office to 237 Lancaster Ave., Devon, Pa. The telephone number is MUrray 8-7764. The district sales manager is William C. Gwynn. Rapid service on orders may be obtained by contacting W. G. Orr at the company's Port Neches, Tex., plant.

KOPPERS CO., INC., plans to expand its Oil City, Pa., plant to produce a broader line of alkylated phenols. The new unit was expected to go on stream by July 1. Some of the new products of this plant will be: para-tertiary butyl phenol; para-tertiary amyl phenol; di-tertiary amyl phenol; and both 2,4 and 2,6 di-tertiary butyl phenol. According to Martin Fritch, manager chemical sales, the butyl and amino-phenols are primarily used in the production of oil soluble resins, detergents, and as oil and rubber additives.

THE LEE RUBBER & TIRE CORP., Conshohocken, Pa., has opened Lee tire sales centers in Strawbridge & Clothier's metropolitan and suburban department stores in the Philadelphia, Pa., and Wilmington, Del., areas. The tire-selling operation, which will be located in Strawbridge & Clothier's downtown Philadelphia, Jenkintown, Ardmore, Pa., and Wilmington, Del., stores brings together two of the oldest firms in the area. The move was planned to give both organizations extended sales coverage throughout the heart of Delaware Valley.

GOODYEAR TIRE & RUBBER CO., Akron, O., plans expanding production facilities at its Niagara Falls, N. Y., vinyl resins plant at a cost of more than $1 million, according to Sam DuPree, vice president in charge of production. The expansion will add about 20 million pounds annually to the plant's total capacity and will double capacity for two specialty dispersion resins handled by the Goodyear chemical division. The resins—Pliovic WO and Pliovic AO—are used in knife, dip, and roller coating applications as well as roto-cast and slush-molding operations for a wide variety of end-products.

SOUTHWEST CHEMICAL & PLASTICS CO., Houston, Tex., plans a plant near Houston for custom production of blends and dispersions of carbon black and other pigments in polyethylene, polypropylene, and other plastics. The newly formed company will have facilities with a capacity of approximately 10 million pounds annually of these blends. Laboratory and research facilities will be included. Completion of the plant is slated for September, 1960. Officers of the new company are T. B. Hudson, president, Ken W. Minix, vice president, and Henry Groppe, secretary-treasurer.

This machine takes 35 seconds to test the variations in a tire's rolling resistance and rolling radius, or "roundness," two factors which affect smoothness of ride. A reading of more than one third of a millionth of one watt on the machine's electric meter being checked by technician indicates that the variations in the tire's rolling resistance are too high. Tires must not be more than 47-thousandths of an inch from perfect roundness to pass the test. The machine, called a "uniformity sorter," was developed by United States Rubber Co., New York, N. Y.

VANGUARD ENGINEERS, INC., a new engineering service firm, has been formed in Houston, Tex., to design and develop custom components of rubber, plastics, and metals, for specific engineering projects. Vanguard principals are associated with F. H. Maloney Co., which manufactures custom products mainly for the petroleum industry. Vanguard will serve as a research, design, and development bridge between customer and manufacturer, using Maloney facilities for compounding, molding, and metal machining. Vanguard is at 520 Dowling St., adjacent to Maloney machine shops, research laboratories, and other designing and testing facilities.

CHLORINATED PRODUCTS DIVISION, Diamond Alkali Co., Cleveland, O., plans to initiate a long-range expansion program at the division's Belle, W. Va., plant, according to L. P. Scoville, division general manager. Initial work will include the erection of new buildings and the replacement of operating equipment to take advantage of recent process improvements. Modernization of facilities for the production of methyl chloride, methylene chloride, and chloroform will result from this initial program which is being started immediately.

DOW CORNING CORP., Midland, Mich., has reduced prices of all its standard viscosities of Dow Corning 200 fluid (dimethyl polysiloxane) and for a series of silicone emulsions based on silicone fluid. Effective June 1, the price of each product was reduced about 4%. Products include Dow Corning 200 fluids and Dow Corning emulsions 8, 35, 35A, 35B, 36, and 37, and Dow Corning mold release fluid. Detailed product and price information is available from the company.

E. I. DU PONT DE NEMOURS & CO., INC., Wilmington, Del., has announced plans for new facilities which will more than double production of nylon yarn for tire cord and other industrial products at its Richmond, Va., plant. Plans call for installation of additional nylon producing units plus increasing production of the existing plant which went into production two years ago. The original plant had a rated capacity of 40 million pounds annually of heavy denier nylon yarn. With the completion of the expansion in the second half of 1961, the Richmond location's capacity will exceed 100 million pounds annually.

STILLMAN RUBBER CO., Culver City Calif., is now offering its new "Viton"-to-metal bonded Permadized Seals for general industry. This real design provides for the bonding of a Stillman "Viton"-based compound to machined metal parts through an exclusive process. The resulting seal can then be micro-precision ground to seal against plane or conical surfaces, as needed. These seals can be used as poppets, swing checks, valve seats, flappers, pistons, and other applications where axial movement is utilized to effect a seal against a surface.

LONG MILE RUBBER CORP.'S new tread-rubber manufacturing plant in Spartanburg, S. C., is now in operation, according to W. R. Phillips, president. Long Mile, headquartered in Dallas, Tex., is one of the nation's largest firms devoted entirely to the production of tread rubber and tire retreading materials. The new plant has a capacity of 6,000 pounds of tread rubber an hour, which almost doubles Long Mile's production capacity, bringing it up to more than 13,000 pounds an hour. The new plant will be managed by Warren Phillips, Jr., assistant vice president of the firm.

SPENCER PRODUCTS CO., Ridgewood, N. J., has appointed R. D. Abbott Co. its West Coast representative for the sale of the accelerator activator, Ridacto. Under the direction of Carl S. Hoglund, the Abbott company represents a number of suppliers to the rubber industry from offices in Los Angeles and San Francisco, Calif.

news about people

C. N. Meier

E. E. McMannis

W. C. Croysdale

Byerly Portrait Studio

W. D. Trammell

J. R. Lill

P. Huber

Eugene E. McMannis, chief engineer, tire design research; **Charles N. Meier,** compounder; and **Walter C. Croysdale,** technical superintendent of the Jackson, Miss., plant, are this year's recipients of Goodyear Tire & Rubber Co.'s R. P. Dinsmore awards for original thinking and cooperative action in developing better products. McMannis was cited for work in developing a new design in ultra-high-speed tires. Meier was noted for his initiative in developing improved tread splice cements which have helped reduce tire adjustments. Croysdale received his honors for contributions to the production of precision tires for original equipment accounts.

Lee Van Slyke is now assistant manager of fatty acid sales for Armour Industrial Chemical Co., Chicago, Ill. He was previously special assistant to **Paul L. Sheppard,** fatty acid sales manager.

Clinton W. Adams has been appointed section manager in charge of development of tread rubber, retreading, tubes and valves, solid tires, accessories, and repair materials for B. F. Goodrich Tire Co., a division of The B. F. Goodrich Co. For the past four years he was a senior development engineer.

David M. Saenger has been named senior technical sales representative for the recently created petroleum and rubber chemicals division, Oronite Chemical Co., San Francisco, Calif., a subsidiary of Standard Oil Co. of California. After a brief orientation period at San Francisco, Saenger will be transferred to the New York, N. Y., office and will be responsible for sales and service of Oronite lubrication oil additives in the eastern states.

William D. Trammell is now sales representative for the western district of the silicone products department, General Electric Co., and will make his office in Dallas, Tex. He recently completed a six-month training program in preparation for his present assignment.

D. N. Morris has been appointed secretary-treasurer of Seiberling Rubber Co. of Canada, Ltd., Toronto, Ont., Canada. He joined the company two years ago.

M. F. Anderson has been elected to succeed **C. C. Thackray** as president and a director of Canadian Lastex, Ltd., Montreal, P.Q., Canada. Thackray will continue as a director.

James C. French is now manager of market research for the polychemicals department, Texas Butadiene & Chemical Corp., New York, N. Y. He formerly served in a market research capacity. **Frederick H. Gilchrest** has joined the company in a sales development capacity with the same department.

James T. Norman has been made technical service engineer for the international department of B. F. Goodrich Chemical Co., Cleveland, O., and will join a group which provides technical assistance on manufactuirng operations for the company's associate and subsidiary companies in England, Japan, Canada, Mexico, Holland, Brazil, and Australia. He is now returning from an assignment in Japan where he gave technical assistance for the construction and initial operations of that country's first synthetic rubber plant. The plant is owned by Japanese Geon, a B. F. Goodrich associate company.

John R. Lill and **Peter Huber** have been named vice presidents of J. M. Huber Corp., New York, N. Y. Lill will continue as head of the chemicals division and as laboratory administrator. Huber will be vice president in charge of finance. Lill will headquarter at Havre de Grace, Md., and Huber at Red Bank, N. J.

Marvin R. Frederick now is manager of the chemical engineering research department at The B. F. Goodrich Co. research center, Brecksville, O. Dr. Frederick joined the research center staff in 1946.

E. G. Wellheiser is now executive vice president and general manager, and **Maurice N. Gauthier** vice president and sales manager of Concord Rubber, Ltd., Lachine, P.Q., Canada, a division of Mailman Corp., Ltd.

H. C. Jeffries has resigned as president and chairman of the board, Viceroy Mfg. Co., Ltd., Toronto, Ont., Canada, but will continue to serve as a director. **T. D. Jeffries** succeeds him as president; while **R. H. Shannon** becomes executive vice president. **E. P. Chester** has been named vice president, marketing; **R. C. Hartwell,** comptroller; and **C. S. Smythe,** vice president of C. Smythe, Ltd., has been appointed to the board.

Ernest Spring has been assigned to special products development for The Standard Products Co., Port Clinton, O. His position involves long-term investigations in line with the rubber division's expanding interests in proprietary items and formulations for unique processing. **James Norton** assumes the duties of chief chemist with responsibility for factory compounding and testing.

W. J. Lee

A. J. Gracia

A. J. Gracia has been appointed director of general research and development, and **W. J. Lee** director of tire research and development at Goodyear Tire & Rubber Co., Akron, O. Gracia, manager of research and development since 1956, is now division director with responsibility for all research, product development, and product service functions affecting all materials, new products, and existing end-products other than tires. Lee, former director of tire engineering, is now in charge of all research, product development, and product service functions directly affecting tires and related products. In addition **M. J. DeFrance,** former director of the new products department, becomes manager of commercial development (a new post); while **J. A. Merrill** has been elevated from associate director of research to assistant director.

S. N. Bolling is now president of Erie Engine & Mfg. Co., Erie, Pa. In addition, **Bernard Sobieraj** is vice president, and **R. E. Weller** becomes general manager; while **Thomas Kramer, Jr.,** serves as sales manager.

A. M. Wightman has been named technical director of Rapid Roller Co., Chicago, Ill. He has had 25 years of experience in the rubber industry and graphic arts fields and succeeds **Philip Schwartz,** retired.

Jean Rodger Nesbit has joined the chemical division of International Latex Corp., New York, N. Y., as regional sales manager for the Middle Atlantic area and will make his office at Rumson, N. J.

J. R. Nesbit

A. E. Laurence

James E. Trainer, Jr., has been named factory manager of the Des Moines, Iowa, plant of The Firestone Tire & Rubber Co. He succeeds **E. H. Strobel,** who assumes a position of greater responsibility at the Akron, O., office. **Charles R. Allen** succeeds Trainer as production manager at Des Moines; while **Ants Aro** replaces Allen as plant engineer.

T. Dean Smith has been appointed manager of the petrochemicals department, American Cyanamid Co., and will headquarter in the New York, N. Y., office. He will be responsible for all commercial operations related to marketing the company's petrochemicals. Prior to this appointment he was assistant manager of the plant at Fortier, Man., Canada.

Ramon A. Mulholland has joined The Richardson Co., Melrose Park, Ill., as manager of the commercial development department. He will be responsible for all market research and development activities not related to present product lines and will develop information to permit expansion through diversification.

R. G. Richards fills the newly established position of director of development, Diamond Alkali Co., Cleveland, O. The creation of the post reflects the increased emphasis on new product development. Richards was previously manager of planning and development for the plastics division.

Harvey E. Phelps becomes manager, mechanical design and construction, of Goodrich-Gulf Chemicals, Inc., Cleveland, O. The former senior engineer is now responsible for the design and construction of new manufacturing facilities for the corporation.

Wyman L. Taylor has been promoted to assistant to the vice president, sales, industrial chemicals division, Stauffer Chemical Co., New York, N. Y., from his former position of western sales manager. He will move his headquarters from San Francisco, Calif., to New York.

John Keramedjian has been appointed group leader for the adhesives and rubber section, technical service department, Schenectady Varnish Co., Schenectady, N. Y. In addition to doing research, he will act as consultant to the trade for adhesive and rubber compounding projects.

Albert E. Laurence joins the technical sales staff of R. T. Vanderbilt Co., New York, N. Y. He will be located in Akron and will call on accounts in that area and the south central states.

J. E. Trainer

C. C. Colozzi

Charles C. Colozzi has been elected president and a director of United States Gasket Co., plastic division of Garlock, Inc., Camden, N. J., and he will serve as the division's chief executive officer. He succeeds **A. J. McMullen,** who resigned to devote full time to his position as president and chief executive officer of Garlock, Inc.

Raymond Cappel has transferred to the New York regional office of Jefferson Chemical Co. and will handle accounts in the Pennsylvania and New Jersey area. He was formerly resident salesman in Tulsa, Okla. **Earl Gilbert** has been appointed office manager for the Chicago, Ill., sales office and will supervise order processing and clerical activities for the entire Chicago region.

John F. Bennett has been elected treasurer of Goodyear Tire & Rubber Co., Akron, O., to fill the vacancy created by the death of **Donald Walker.** Bennett previously was assistant treasurer.

Donald L. Wilson has been appointed representative for Parker Seal Co., Culver City, Calif. He will cover the western Ohio and eastern Pennsylvania area, with his headquarters in Stow, O.

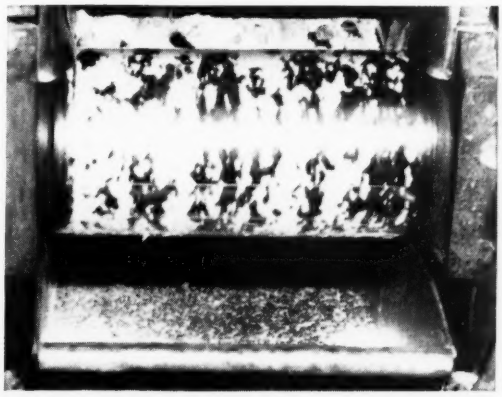
Harold W. LeBoeuf has been made manager of manufacturing of General Electric's silicone products department, Waterford, N. Y. He succeeds **James R. Donnalley,** now general manager of the company's insulating materials department. LeBoeuf formerly served as manager of intermediates operations.

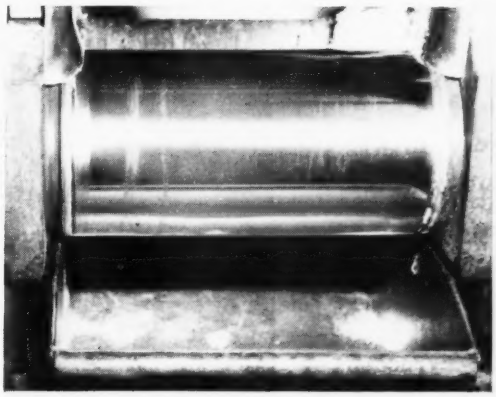
J. Keramedjian

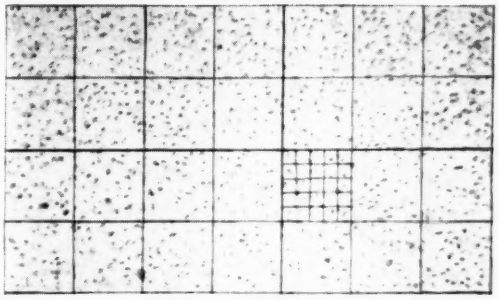
H. W. LeBoeuf

Naugatuck DELAC-S

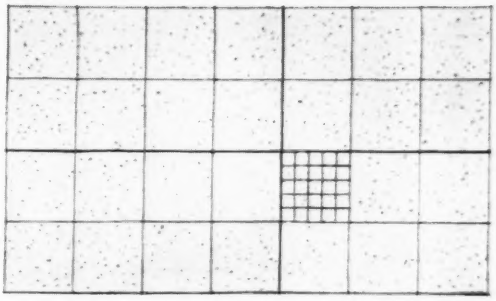
FROM A WORLD LEADER IN RUBBER CHEMICALS







POWDERED COMMERCIAL PRODUCT
Bad caking and fall through, uneven dispersion. Incorporation time, 1'45".



NEW IMPROVED DELAC-S
No caking, minimum fall through, more thorough dispersion. Incorporation time, 45".

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As the above pictures illustrate, new improved DELAC®-S delayed action accelerator speeds and simplifies processing, disperses more readily and thoroughly for maximum effectiveness.

Developed after many months of research and experiment to overcome the mixing and dispersion difficulties encountered with the present commercial sulfenamides, new improved DELAC-S makes it possible to . . .

obtain improved dispersion
decrease incorporation time
minimize fall through
eliminate back roll and Banbury rotor caking

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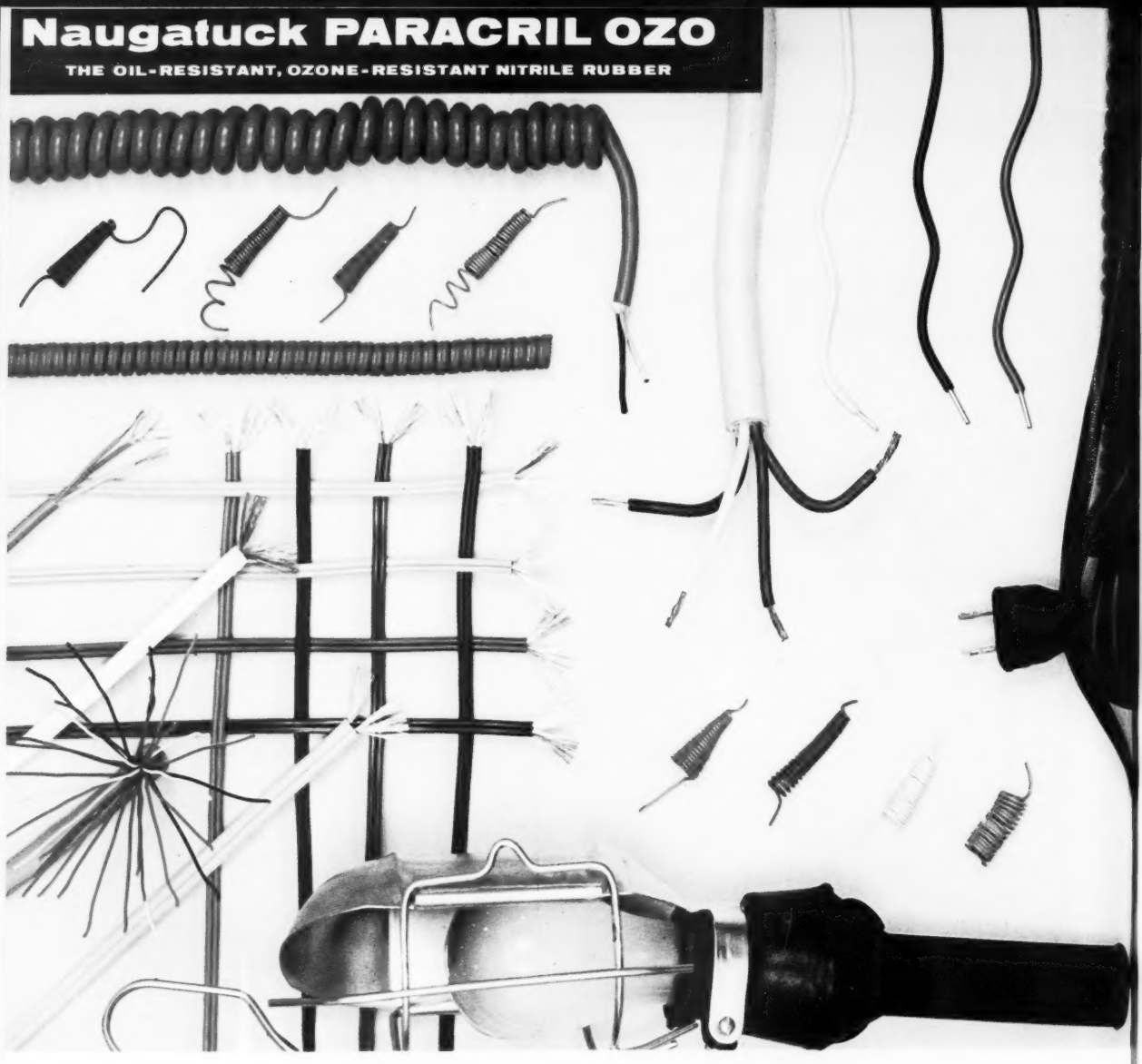
Naugatuck PARACRIL OZO

THE OIL-RESISTANT, OZONE-RESISTANT NITRILE RUBBER



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J. S. Collbran, Jr.

Matar Studio

R. J. Delack

A. Ohlander

Matar Studio

F. A. Gilson

R. W. Munson

Joseph W. Selden has been elected divisional vice president for the chemical division, Minnesota Mining & Mfg. Co., St. Paul, Minn. He has been with the company since 1948 and, since 1959, has been general manager of the chemical division.

Daniel B. Lamb has been appointed Detroit division manager for Oakite Products, Inc., New York, N. Y., to replace **Thomas R. Smith,** who retired after 19 years as head of the division. For the past seven years Lamb was technical service representative in the Kokomo, Ind. area.

C. Randall Thomas has been promoted to manager, process engineering section of the research and development department, Texas-U.S. Chemical Co., Port Neches, Tex. He joined the company in January, 1956, at Parsippany, N. J., and in April, 1959, transferred to Port Neches.

Joseph R. Klein fills the newly created post of marketing director, Vanderbilt Tire & Rubber Corp., New York, N. Y.

Robert F. Love has been named administrative assistant to F. A. Gilbert, manager of the inorganic chemicals department of Food Machinery & Chemical Corp., New York, N. Y. Love was previously general operating superintendent of the company's Green River, Wyo., soda ash operation.

John T. Sullivan has been appointed market research and development analyst for Goodrich-Gulf Chemicals, Inc., Cleveland, O. He was with The Richardson Co., where he was a commercial development engineer doing market research and development work on elastomeric materials.

Glen D. Cross is now manager of development and training for production management at The Firestone Tire & Rubber Co. Akron, O. He will have responsibility for the development and training of production management and personnel in all Firestone plants.

Robert W. Munson becomes southern district sales manager in charge of a new sales district with headquarters in Atlanta, Ga., for The New Jersey Zinc Co., New York, N. Y. He was formerly assistant eastern district sales manager. **Alfred Ohlander** has been assigned the Pacific district sales managership. **Robert J. Delack** succeeds him as head of the Boston, Mass., office; while **Frank A. Gilson** replaces Delack as pigment sales representative in the New York metropolitan office. Gilson was manager of the sales office division. **J. Stuart Collbran, Jr.,** is now manager of purchasing, with headquarters in New York. He was formerly Pacific district sales manager.

M. J. Mighdoll has been named executive vice president of the National Association of Secondary Material Industries, New York, N. Y., and **Si Wakesberg** is commodities vice president. Wakesberg is also secretary of the metal divisions.

M. R. Batche is now manager of safety for all manufacturing plants of The Firestone Tire & Rubber Co., Akron, O. With the company since 1934, Batche joined the safety department in 1955.

George dePasquale has been appointed vice president in charge of marketing for Baird Chemical Industries, Inc., New York, N. Y., chemical manufacturer and importer. Formerly a sales representative, dePasquale will now be responsible for the company's expanded marketing programs in various industries, including rubber.

G. dePasquale

R. J. Luebbers

Henry P. Donohue, Jr., has been named market development manager, titania, of the newly created development department at Godfrey L. Cabot, Inc., Boston, Mass. He was formerly eastern regional sales manager of nonceramic industries in the minerals and chemicals division.

C. Wells Moore, Jr., joins Southern Latex Corp., Austell, Ga., in a sales advisory capacity and will make his headquarters in the Dalton, Ga., office. He has been engaged in the yarn and tufted textile industry for several years and is president and owner of Moore Textiles.

E. J. Thomas, president, Goodyear Tire & Rubber Co., Akron, O., has been named chairman of the rubber industry committee of Project HOPE. This project will send a 15,000-ton hospital ship, equipped to serve as a medical training center, to Southeast Asia this summer to bring medical knowledge and techniques to newly developing countries.

Julian B. McFarland has been named manager of the Houston, Tex., plant of Pennsalt Chemicals Corp., industrial chemicals division. He will direct the operations of recently enlarged organic sulfur chemicals facilities, for which further expansion is now in progress.

Donald C. Hay is now development engineer in charge of airplane tire compound development for B. F. Goodrich Tire Co., a division of The B. F. Goodrich Co., Akron, O. Hay was section manager of new products development for the aviation products division for the past three years.

R. J. Luebbers becomes director of quality control and technical service for the United States and Canadian tire plants of The Firestone Tire & Rubber Co., Akron, O., and will be responsible for the chemical laboratories in the plants. Prior to this appointment he was manager of technical service and became responsible for quality control and technical service activities for all plants in the two countries.

John H. Sanders has been appointed sales manager of the chemicals division, Eastman Chemical Products, Inc., Kingsport, Tenn. Formerly a regional sales manager with headquarters in Cleveland, O., he succeeds **Guy A. Kirton,** who will now concentrate on international sales for Tennessee and Texas Eastman products. Sanders' former region has been divided between the Midwest and eastern regional offices, with the former under the direction of **Decatur B. Campbell,** and the latter headed by **Robert H. Cannon. R. Clay Dubberly** has been put in charge of the Cleveland office, which serves northern Ohio; while **George O. Trabue,** formerly of the Cleveland office, will supervise the new sales office to be opened in Buffalo, N. Y. **Kenneth E. Cox** has been made district sales manager at Skokie, Ill.; while **H. Lynn Francisco** moves to the St. Louis, Mo., office to replace Cox. **Robert M. Morrow** will transfer to the new Kansas City office to take charge. **C. P. Echerd** has been named district sales manager of the New York, N. Y. office. **Ralph R. Shelly** will serve as sales coordinator at Kingsport, exchanging duties with **G. C. DeCroes,** now in charge of the Cincinnati office.

J. P. Anderson, president and general manager of Dunlop Canada, Ltd., Toronto, Ont., has been elected president of the Ontario Safety League.

Galo Blanco, primarily responsible for the establishment of the Tyrex, Inc., field activities program, has been transferred from New York, N. Y., to Cleveland, O., to direct accelerated operations in the field. He will act as direct liaison between the Tyrex field staff and truck fleet operators in a concentrated information program. **Robert A. Fitzgerald,** formerly New England representative, moves into New York to assist in the management of the information program. **Walter Bagdon** will cover the eastern regional area from offices at Westport, Conn.

The Firestone Tire & Rubber Co.'s chairman, Harvey S. Firestone, Jr., recently laid the cornerstone for a multi-million-dollar tire manufacturing facility in Bethune, France. The plant, to be completed late this year, is Firestone's eighteenth plant overseas and its first in France. The facility will produce a full line of tires and tubes to help meet the growing demand of European markets. It is said to be part of a world-wide $120-million expansion program recently announced by the company.

A. J. Ashe becomes manager of business research of The B. F. Goodrich Co., Akron, O. For the past three years he was business economist for Butler Mfg. Co., Kansas City, Mo.

OBITUARY

Ferdinand Vogel

Hans Wyman

Hans Wyman

Hans Wyman, president of H. O. Canfield Co., Bridgeport, Conn., and of The Pantasote Co., Passaic, N. J., died June 9, of a heart attack, at his home in New York, N. Y.

He was born June 13, 1885 in Aussig, Czechoslovakia. He attended a commercial college. In 1928 he became proprietor of Ed. J. Weinmann, Coal Miners & Distributors, Aussig. He was a leader of Czech coal and steel industry, director of Bohemian Union Bank and Dresdner Bank, and of Westboemischer Bergbau Aktien-Verein, Prague, Czechoslovakia.

The deceased came to the United States in 1941. In 1942 he became president of the Pantasote and Canfield companies.

Funeral services were held June 11 at Frank E. Campbell Home, New York, and Mr. Wyman was buried the same day at Ferncliff Cemetery.

He is survived by his wife, three sons and a daughter, as well as 12 grandchildren.

CALENDAR of COMING EVENTS

June 13-September 2
Gordon Research Conferences. Colby Junior College, New London, N. H.; New Hampton School, New Hampton, N. H.; Kimball Union Academy, Meriden, N. H.

July 22
Chicago Rubber Group. Golf Outing.

August 2
New York Rubber Group. Golf Tourney. Forsgate Country Club, Jamesburg, N. J.

August 19
Philadelphia Rubber Group. Annual Outing. Manufacturer's Country Club, Oreland, Pa.

September 6-16
Production Engineering Show. Navy Pier, Chicago, Ill.

September 7-9
Chemical Institute of Canada and National Research Council. Tenth Canadian High Polymer Forum. Alpine Inn, Ste. Marguerite, P.Q., Canada.

September 10
Northern California Rubber Group. Outing.
Connecticut Rubber Group. Outing.

September 11-16
American Chemical Society. New York, N. Y.

September 13-16
Division of Rubber Chemistry, ACS. Hotel Commodore, New York.

September 26-30
Instrument Society of America. Annual Meeting and Fall Instrument-Automation Conference and Exhibit. Coliseum, New York, N. Y.

September 29
Southern Ohio Rubber Group. Engineers Club, Dayton, O.

September 30
Rubber Chemical Salesmen's Association of Akron. University Club of Akron, Akron, O.

October 4
The Los Angeles Rubber Group, Inc.

October 7
The Philadelphia Rubber Group. Poor Richard Club, Philadelphia, Pa.
Detroit Rubber & Plastics Group, Inc. Detroit Leland Hotel, Detroit, Mich.
Chicago Rubber Group. Furniture Club, Chicago, Ill.

October 7-8
Southern Rubber Group. Roosevelt Hotel, New Orleans, La.

October 9-11
Rubber & Plastics Division and Erie Section, American Society of Mechanical Engineers. National Conference of Rubber and Plastics Engineers. Hotel Lawrence, Erie, Pa.

October 12-23
Automobile Manufacturers Association. 1960 National Automobile Show. Cobo Hall, Detroit, Mich.

news from abroad

The Japanese Rubber Industry

"In 1958 consumption of new rubber in Japan totaled 146,700 tons. This is well over the record high achieved the previous year. In 1959 we will use 190,000 tons or more, and in 1960—200,000 tons!

"So it is not surprising that exports of finished rubber goods are also setting new records every year. Last year we exported $53,350,000 worth. We expect to ship out $70,000,000 worth in 1959. And in 1960—our export business will exceed $80,000,000!"

So run the opening paragraphs of the foreword to the 1959-60 edition of "Japan's Rubber Goods," year book of the Japanese Rubber Manufacturers' Association.

From it we learn that after the strict postwar controls in imports of crude rubber were lifted in April, 1950, the Japanese rubber industry shot ahead. Prewar consumption of 60,000 tons was quickly reached again; by 1953, the figure had risen to 90,000 tons, and in 1956, to 120,000 tons. Now Japan ranks fifth among rubber consumers (if Russia is excluded) after the United States, Britain, West Germany, and France.

The Japanese rubber industry includes a large number of minor companies employing under 300 workers, and a small number of major firms, employing anywhere from 300 to more than 5,000 persons. In 1958, under 25% of the total number of firms produced 77.5% of the entire output and employed 63.2% of the workers in the industry, and there seems to be a small, but noticeable trend away from smaller in favor of larger establishments.

The main products are automobile tires and tubes, which in 1958 accounted for 35% (more than 50,000 tons) of the new rubber used in that year, followed by footwear with 24% (vinyl footwear, we note, made up 14.9% of total "rubber" footwear output in 1958); industrial goods — 12%; hose and belting—7%; latex products—7%. Foam rubber articles, though relatively recently added to Japanese rubber products, have become quite popular, and 1959 was expected to show output of 10,000 tons.

Manufacture of automobile tires is virtually confined to six large firms; however, statistics for 1957 and 1958 list small percentages of tires among the products of minor companies. A significant switch is noted in footwear production which has apparently been displaced by industrial goods as a major interest of smaller firms. Footwear formed 25.6% of total output of smaller firms in 1954, but only 7.9% in 1958; on the other hand, industrial goods jumped from 21 to 31.5%. The fact that there are now large rubber footwear factories, employing more than 5,000 persons, may explain the change. The items listed as "other goods" also showed a sharp advance, from 20.9 to 29.9%.

Exports are vitally important to Japan, and to insure that no inferior goods are shipped out, and confidence in Japanese products is maintained in foreign markets, the government has enacted an export inspection law which specifies rigid testing methods for rubber and plastics export goods. The tests are applied by the Rubber Goods Inspection Association, which is not a government organization, but is recognized by the Japanese Government as the exclusive testing agency for these branches.

In 1958, Japan exported rubber goods to a value of more than $53,000,000—22% more than the record figure for 1957, and ten times higher than in 1950. Footwear, automobile tires and tubes, and rubberized cloth, in that order, were the chief articles exported in 1958. Until 1958, automobile tires and tubes had consistently headed exports; then sales to foreign countries dropped to $16,253,000 from $18,971,000 the year before; while footwear rose to $18,951,000, more than double the 1957 figure of $8,809,000. Rubberized cloth advanced similarly, from $3,675,000 in 1957 to $7,316,000 in 1958.

The annual figures from 1954 to 1958, inclusive, show that the United States was Japan's best customer every year except 1956, when Hong Kong was first. In 1958 U. S. purchases, valued at $15,911,000 and representing 29.8% of Japan's export business that year, were three times as high as in 1957. The U.S.A. bought footwear to a value of $11,000,000 (more than half of the total exported); 39% of the rubberized cloth (against only 9.4% in 1957 and 1.8% in 1956); and 42% of the rubber toys. The sharp increase in direct United States purchases of rubberized cloth and a simultaneous drop in those by Hong Kong after years during which it had led here suggest large reexports by Hong Kong to the United States in the earlier years.

As a block, the Asian countries are Japan's best customers; they took 51.5% of total exports in 1958. Thailand, with 6.2%, led, followed by Iran, Saudi Arabia, Kuwait, Taiwan. To these countries went almost half the tire exports, Thailand again leading; Asian countries also took substantial amounts of hose and belting. Japanese toys find markets all over the world.

The rapid rise in production and exports in the past four years has encouraged highly optimistic estimates of future growth. The Japan Rubber Manufacturers' Association recently announced that output is expected to increase 8.5% annually so that by 1965 consumption will be at the rate of

The Japan Rubber Manufacturers' Association

Typical of operations in the revived rubber industry in Japan are these girls making bicycle tires

319,000 tons. The following table gives the estimates (in tons) for the chief products in 1960 and 1965.

	1965	1960
Passenger tires and tubes	105,000	63,000
Cycle tires and tubes	12,200	10,800
Rubber-soled canvas shoes	15,200	10,200
Rubber shoes	21,000	18,000
Vinyl shoes	15,000	9,700
Belts	13,200	8,700
Hose	7,500	5,000
Rubber coatings	12,000	9,000
Industrial uses	44,000	27,800
Cables	10,000	7,200
Latex goods	35,000	20,000

Japanese Firm Puts SBR Plant On Stream

A $30-million synthetic rubber plant designed by Blaw-Knox Co., Pittsburgh, Pa., was dedicated recently at Yokkaichi, Japan. Owned by Japan Synthetic Rubber Co., Ltd., the plant is designed to produce an annual output of 40,000 metric tons of SBR crumb rubber and 5,000 metric tons of synthetic latex. The plant site is in the area of a major petrochemical complex where other plants are manufacturing styrene and butanes and butylenes.

The styrene used in the process is supplied by pipeline. The first LPG tanker in Japanese coastal service brings other raw materials to the plant.

Work on the plant began in August, 1958, under supervision of a Blaw-Knox management team. Ground was broken in October, 1958.

The first full copolymer production runs were made in January, 1960. Licensor for the copolymer section of the plant is Goodyear Tire & Rubber Co.

The butadiene section of the plant started operations in March, 1960. Process information and licenses for this section were provided by Houdry Process Corp. and Esso Research & Engineering Co.

Natural Rubber Price Hits High in Mid-May

Analysis of prices in recent months gives an average for February of 115.12 cents (Straits currency) per pound; for March, 119.05; for April, about 120 cents; and for May, about 129 cents. The upswing, which suddenly started in the latter part of April, to reach 124 cents at the end of the month—the highest since last November — continued to the middle of May, when prices shot to a level not attained since September, 1955. At one stage on May 13, business was done at 143¼ cents; prices tapered off to 125½ cents by the end of the month.

There has been much speculation on the cause of this sudden rise. Undoubtedly the political situation was a factor, and timely purchases by Communist bloc countries, although small, had a psychological effect. The view, on the whole, seems to be that the squeeze resulted because some dealers were caught short for May deliveries. *The Financial Times* suggests that it is more likely that one or two big deals were involved rather than several small ones and adds that, since the need seemed to be mainly for No. 1 rubber, a purchase by Russia or China might be behind the situation, as the Communist bloc is known to have a strong preference for this grade.

Discussing the firmness of the market later in May, the paper stresses the vital importance for the rubber market of a knowledge of the size of the stocks held by Chinese dealers. The Chinese dealers, it said, now have a very large part of the Far Eastern rubber trade in their hands, and some of them have the resources to enable them to hold back large stocks of rubber from the market for several months if they wish to do so.

Report on Malayan NR Research Conference

By the middle of May some 50 experts from 13 countries had registered for the Natural Rubber Research Conference, sponsored by the Rubber Research Institute of Malaya with the support of the Federation Government and the Rubber Producers' Council, and scheduled to be held in Kuala Lumpur, September 26-October 1. They represented Belgium, Brazil, Cambodia, Ceylon, France, Indonesia, India, Japan, Liberia, North Borneo, Britain, the United States and Vietnam. Delegates are also expected from Australia, West Germany, and Italy, and there will be 50 more from Malaya and Singapore. More than 80 papers had already been submitted in May.

The wide range of subjects covered will be dealt with at concurrent meetings of two sections—one for research on natural rubber production, and the other for research on the preparation and use of natural rubber and latex. Guest speakers will address three general sessions; they are:

Prof. G. E. Blackman, Professor of Rural Economy, at Oxford, who, it will be recalled visited Malaya a few years ago to advise on measures to strengthen the natural rubber industry here. He will discuss "The Stimulation of Latex Flow by Plant Growth Regulators."

Prof. James Bonner, Professor of Biology, California Institute of Technology, who will deal with "Biogenesis of Rubber."

Prof. Geoffrey Gee, Professor of Chemistry, University of Manchester, who will speak on "New Methods of Elastomer Synthesis and Their Impact on Natural Rubber."

Oppose Rubber Exchange

A certain section of the rubber trade outside the Federation is strongly opposed to the government's intention of setting up a rubber exchange and is rumored to be attempting to sabotage the plan by threats and intimidation of those members of the trade who are working to promote the scheme, the Minister of Commerce & Industry, Inche Mohammed Khir bin Johari, told the Rubber Exchange Committee at its first meeting, on May 29. The Committee is to study the type of rubber market organization suitable for Malaya and to draft laws to enable it to function effectively.

The Minister made it clear that if the rumors proved to be true, the government would take suitable action.

"It is not our intention to disrupt old-established channels of trade, but no one should be left in any doubt that any deliberate obstruction of our aims would be met by whatever means is necessary to enable us to achieve our objects," he reportedly said.

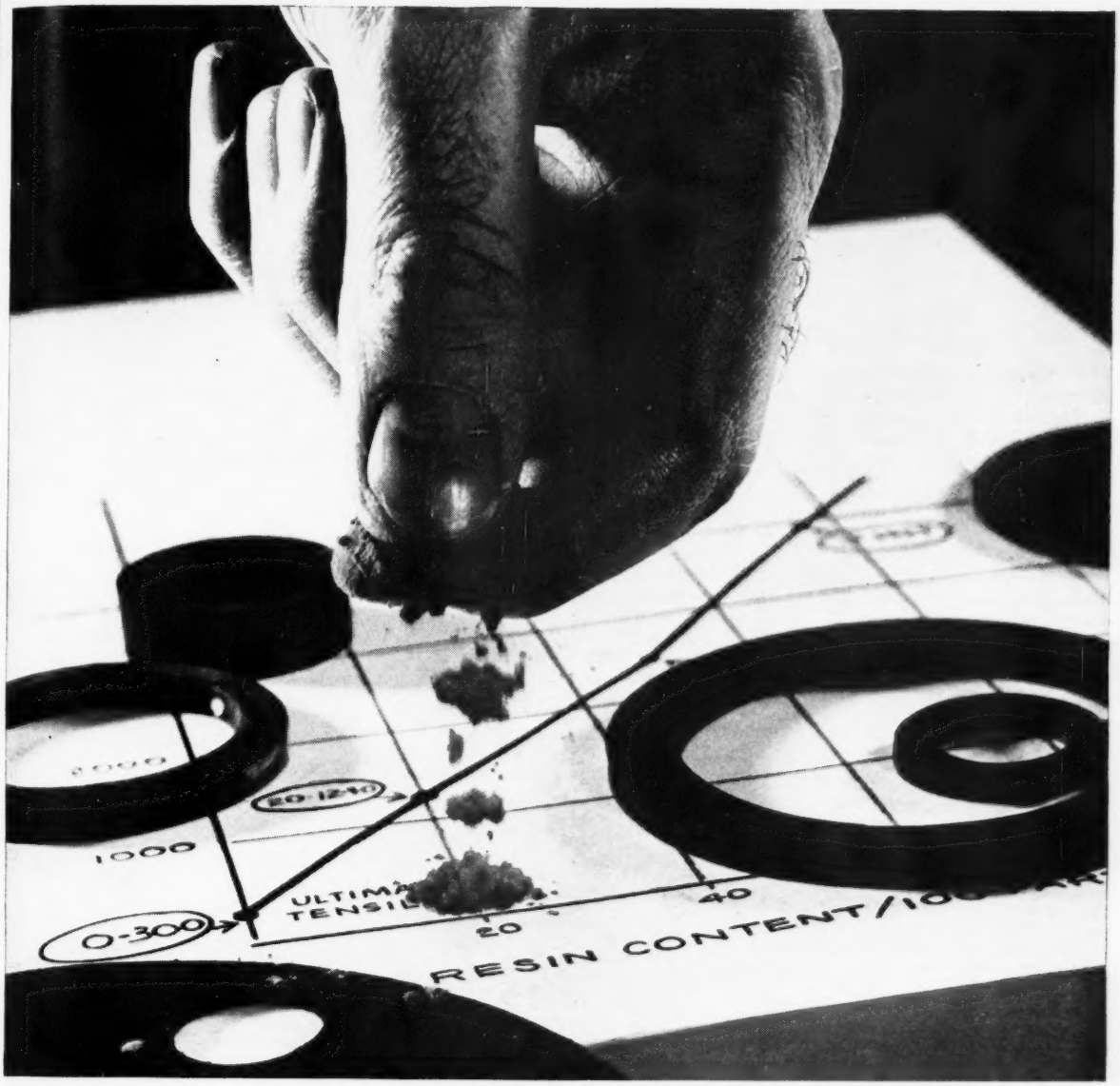
Pelletized News

NEOPRENE RUBBER is now being produced on a commercial scale at the Du Pont (U.K.) works at Maydown, near Londonderry, North Ireland. The Maydown establishment has facilities for producing chemicals needed for the polymerization process. The types of neoprene rubber and latices most in demand are to be produced on a scale sufficiently large to cover the needs not only of Britain, but also of Western Europe and of Commonwealth countries.

J. CONDINA VILLALONGA, Barcelona-San Andres, Spain, has been granted a license to manufacture, use, and sell resilient shoe soles under the patents and trade marks of Ripple Sole Corp., Detroit, Mich. Plans have been formulated to begin immediately making the necessary molds for producing Ripple Soles to meet the current demand in Europe. J. Condina Villalonga is one of the leading rubber firms in Spain.

PIRELLI S.P.A., Milan, Italy, is building two plants for manufacturing standard automobile tires and mechanical rubber goods on its 87-acre property at Settimo Torinese. The cost of the new plants, which will start with raw materials and manufacture finished products, is estimated at more than $8 million. These facilities will occupy

(Continued on page 125)



Add a pinch of permanence...

and watch the good properties grow

Mix a little Durez phenolic resin with nitrile rubber, and notice how the performance curves of the vulcanizate shoot upward.

In a typical recipe, ultimate tensile zooms from 325 to 1330 when you add only 20 parts of resin on 100 parts of nitrile rubber.

Increase it to 50 parts of resin, and tensile goes to 2600. Shore A hardness swings up steeply. Elongation drops off. Stiffness and abrasion resistance both climb.

These properties don't disappear, either, when the going gets rough. After 70 hours at 212°F in air, they're virtually undiminished. You get *more permanence* than with other types of resin.

Fast cure without sulfur: Using 75 parts or less of resin on 100 parts of nitrile rubber, you can cut down on your sulfur and accelerators—and still get a rapid, complete cure.

On 100 parts or more of resin, you can *forget* sulfur and accelerators. The resin provides all the reactivity you need to cure the rubber, with or without filler, and often in record time.

Think of the advantage a no-sulfur compound gives you in gaskets or other molded pieces that must coexist with a lead-oxide paint or must remain neutral in an electrical environment.

You can get Durez resins for modifying the properties of nitrile rubber or SBR, natural rubber or Neoprene, and for making solvent-type adhesives that stick better. They come in powders, lumps, liquids, and emulsions to suit your process. To find out more about them, write us for the illustrated bulletin "Durez Resins in the Rubber Industry."

DUREZ PLASTICS DIVISION

207 WALCK ROAD, NORTH TONAWANDA, N. Y.

HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS

market reviews

Natural Rubber

There was a slight change in the market picture of natural rubber in the May 16 to June 15 period. The shortage of RSS #1 in Singapore which had forced prices up during May eased somewhat in late May and early June owing to a slowed offtake and increased offerings from up-country.

This surplus of No. 1 rubber available for shipment from the Far East would normally indicate a general softening in the market. The London and New York markets, however, were still laboring under a shortage of near rubber and failed to follow the Singapore lead. Therefore prices rose slightly again in the latter part of this period in Singapore, with the final price being in the 37.5¢ range.

Figures released by the International Rubber Study Group in May give added weight to those people who are predicting a surplus of natural rubber for 1960. IRSG predicts world production of 2,135,000 long tons and world consumption of 2,110,000 long tons, for an excess of 120,000 long tons. In addition, the sales formulas of both Britain and United States of stockpiled rubber would permit sales of 75,000 more long tons if current prices hold. This would increase the excess to almost 200,000 long tons, the first time that production would exceed consumption for many years.

The Natural Rubber Bureau, Washington, D.C., announced during this period that Malaya had become the No. 1 supplier of natural rubber to the United States during 1959. Malaya supplied 185,000 long tons of the U.S. 573,000 long tons requirements. The second largest supplier was Indonesia, which sent approximately 158,000 long tons. Other suppliers were Thailand, Viet Nam, Cambodia, Laos, Ceylon, and Liberia. The report further predicted that Malaya would become the largest rubber producing state in the world, with 730,000 long tons for 1960, compared with the previous leader's, Indonesia, predicted 725,000 long tons.

The General Services Administration announced sales of 6,446 long tons of stockpiled rubber in May to bring total sales to 67,726 long tons to date. GSA received Congressional approval to sell 470,000 long tons over the next nine years. Total sales to date would be included in this new program. Scheduled deliveries from stockpile are: 2,868 in June, 1,616 in July, and 1,659 long tons in August.

May sales, on the New York Commodity Exchange, amounted to 14,060 long tons, up from April sales of 10,070 long tons, but not quite matching the March sales of 14,130 long tons. There were 21 trading days in May and 22 in the May 16-June 15 period.

On the physical market, RSS #1, according to the Rubber Trade Association of New York, averaged 44.68¢ per pound for the May 16-June 15 period. Average May sellers' prices for representative grades were: RSS #3, 42.36¢; #3 Amber Blankets, 40.16¢; and Flat Bark, 35.67¢.

REX CONTRACT

1960	May 20	May 27	June 3	June 10
May	44.75	....	....	....
July	42.80	42.30	42.92	43.10
Sept.	40.76	40.90	41.25	41.10
Nov.	39.90	40.00	40.37	41.10
1961				
Jan.	39.20	39.25	39.60	39.25
Mar.	38.50	38.40	38.85	38.70
May	37.60	37.60	38.20	38.25
July	....	36.80	37.40	37.80

NEW YORK OUTSIDE MARKET

	May 20	May 27	June 3	June 10
RSS #1	45.00	44.75	44.00	44.50
#2	44.50	43.50	43.75	44.25
#3	43.50	42.50	43.25	43.75
Pale Crepe				
#1 Thick	49.25	48.25	47.50	48.00
Thin	49.50	48.50	47.50	48.00
#3 Amber Blankets	40.75	40.38	40.00	40.00
#3 Thin Brown Crepe	40.50	40.13	39.75	39.75
Standard Flat Bark	36.00	35.50	35.00	34.75

Synthetic Rubber

Consumption of new rubber in the United States for May totaled 133,275 long tons, compared with the 132,284 long tons consumed during April. Synthetic rubber production, amounting to 126,689 long tons for May, was up somewhat from the 120,895 long tons produced in April, according to the monthly reports of The Rubber Manufacturers Association, Inc.

Consumption of all types of synthetic rubber rose to 91,865 long tons in May, contrasted with the 90,252 long tons in April. Synthetic rubber accounted for 68.93% of total new rubber consumption, against the previous high April ratio of 68.23%.

Consumption (in long tons) by type in May increased for all types except CR (neoprene), as follows: SBR, 77,375 against 75,849; CR, 6,440, against 6,525; IIR (butyl), 5,560, against 5,492; and NBR (nitrile), 2,490, against 2,386.

Total synthetic rubber exports for May dropped to 29,650 long tons from the 36,715 long tons in April; while total synthetic stocks were 227,495 long tons in May, contrasted with 221,511 in April.

Masterbatch production showed a general upward trend. Black masterbatch was up to 4,071 long tons in May from the low April figure of 2,845 long tons. Oil black masterbatch rose to 23,023, against the March output of 21,258 long tons. Oil masterbatch in May reached 36,895 long tons, compared to the 32,461 long tons produced in April.

Latex

The May 16 to June 15 period was characterized by the same quiet drum latex market as has existed for the past several months. While there has been some activity, most buyers have pursued a hand-to-mouth policy, and interest has centered mainly on the near position. The few scattered inquiries for forward shipment have involved very small quantities.

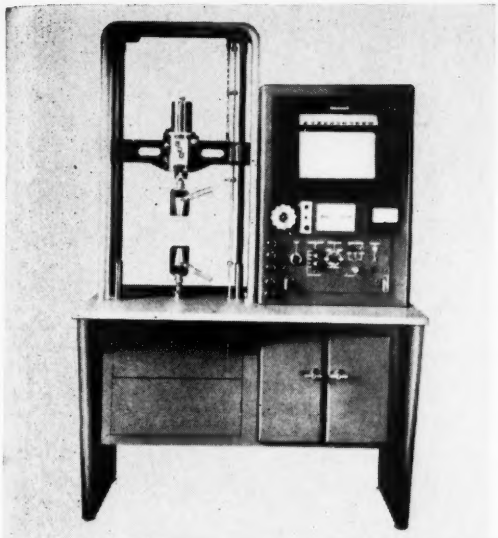
There is a feeling among many quarters that a number of consumers are not too well covered for the future so that any appreciable reduction in rubber values might encourage buyers to show more interest.

The bulk latex market also is very quiet, but some business for shipment in the last quarter was recently reported.

United States stocks of natural rubber latex at the end of April dropped slightly to 13,896 long tons from the 13,964 long tons on March 31. These stocks are sufficient for a three-month supply at current rate of consumption. April consumption was 4,199 long tons.

Malayan shipments during April rose slightly to 10,463 long tons, compared with the 10,139 long tons in March. 2,835 long tons were shipped to U.K., 1,858 to U.S.A., and 1,205 to Japan. March figures had been 2,025, 2,302, and 1,544, respectively.

Prices for ASTM centrifuged concentrated natural latex, in tank car quantities, f.o.b. rail tank car, ran about 48.85¢ per pound solids. Synthetic latices prices were 26 to 40.24¢

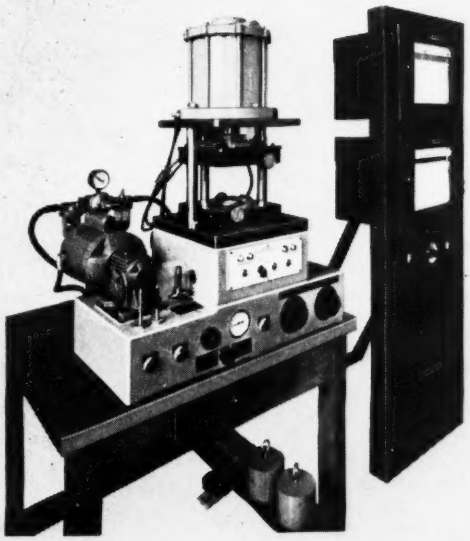


NEW PUSH-BUTTON ACCURACY FOR TENSILE TESTING!

Test high and low elongation, tear strength, and other physical qualities of your rubber products on the versatile Scott Model CRE Constant-Rate-of-Extension electronic tester. New push-button controls make rubber testing a simple, accurate operation . . . offer greater-than-ever operating convenience and testing economies. Ultra-precise *electronic weighing* system provides an infinite variety of crosshead speeds . . . wide selection of test load ranges to 1000 lbs. . . . instant response to rapidly fluctuating loads. Automatic gauge compensation also provides *direct-in-psi* readings for testing elastomeric stress.

The ratio of crosshead speed to recorder chart speed is adjustable over a wide range, giving ample magnification for practically all materials. Elastomer pipping circuit provides manually-controlled representation of visually-observed specimen elongation. A new Scott clamp-locking assembly also reduces clamp-changing time to a *matter of seconds!* The Model CRE makes use of *all* Scott clamps and fixtures to meet ASTM, ISO, government and rubber industry test methods.

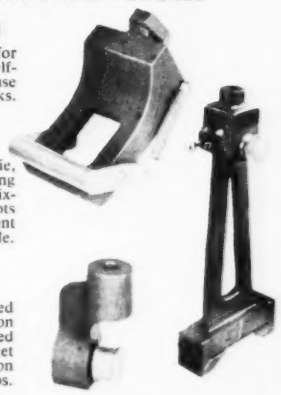
SCOTT TESTERS FOR RUBBER



PUSH-BUTTON AUTOMATION FOR VISCOSITY TESTING!

Determine viscosity, scorch and cure characteristics of rubber and other elastomers with the new, improved Scott Model STI Mooney Viscometer plus Viscosity and Temperature Recorders. Fingertip, pneumatic-powered controls close two-part sample area uniformly — without effort or adjustments. Precise temperature control within ±½°F. at any set temperature to 450°F. Fast-setting spring adjustment saves time, facilitates calibration. New fully-enclosed gear box assures steady readings . . . easier maintenance, fewer repairs, less downtime. Scott Shearing Disc Viscometers — and *only* Scott — are universally accepted as meeting requirements of ASTM Designation D1646 (formerly D927 and D1077) and ISO/TC45 Proposals 411 and 440.

QUICK-CHANGE SCOTT CLAMPS AND FIXTURES



Z-1 CLAMP FOR TENSILE TESTING

One of the industry's most popular clamps for general purpose rubber testing. This is a self-closing clamp developed by the Gas Defense Service, U.S.A. for testing gum and soft stocks. Roll is ⅜″ in diameter and 1¾″ in length.

LORD ADHESION FIXTURE

Designed by the Lord Manufacturing Co., Erie, Pa., for evaluating rubber-to-metal bonding strength. Adaptable to Scott clamps, this fixture accepts a metal backing plate and pivots on a nylon bearing to insure positive alignment during stripping of 1″ wide rubber sample. Meets ASTM Method of Test D-429.

RING TEST SPOOLS

This Scott clamp is used for testing ring-shaped rubber samples and loops of rubber thread on a sled base. Spools are ball-bearing mounted . . . lower spool with chain-driven sprocket revolves as strain is applied, for even tension on both sides of loop or ring. Capacity 150 lbs.

WRITE FOR COMPLETE DETAILS ON MODEL CRE . . . MODEL STI . . . SCOTT CLAMPS . . . AND OTHER SCOTT TESTERS DESIGNED FOR RUBBER AND ELASTOMER PRODUCTS

SCOTT TESTERS

THE SURE TEST . . . SCOTT!

SCOTT TESTERS, INC.
90 Blackstone Street
Providence, Rhode Island

for SBR; 37 to 57¢ for neoprene; and 45 to 60¢ per pound for NBR.

(All figures in long tons, dry weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
Mar.	0	5,127	4,847	13,964
Apr.	0	*	4,199	13,896
SBR				
Mar.	9,351	—	8,104	8,055
Apr.	9,408	—	7,154	9,081
Neoprene				
Mar.	1,004	0	1,076	1,518
Apr.	1,137	0	913	1,595
Nitrile				
Mar.	1,217	0	927	2,492
Apr.	917	0	976	2,379

* Not yet available for period covered.

Reclaimed Rubber

The reclaimed rubber business remained in the doldrums during the May 15-June 15 period. A Midwest reclaimer, reporting that the anticipated pickup did not materialize, foresees no improvement in the near future.

But an eastern reclaimer is more optimistic. Reporting that reclaimed rubber consumption is following the trend of 1959—an excellent first quarter, but a much slower second—this reclaimer felt that with new car sales at a high level, indications were that reclaim sales would improve toward the end of June. Besides, many concerns have been preparing for one- or two-week shutdowns, necessitating building up inventories for sales during that time.

An eastern reclaiming company, moreover, plans a broad expansion program both in the United States and abroad.

According to The Rubber Manufacturers Association, Inc., reclaimed rubber consumption for May was estimated at 23,810 long tons, against 24,210 long tons in April. Respective production figures are 25,510 and 26,209 long tons. No reclaim was imported in May, but 12 long tons were in April. Exports for the respective months follow: 1,230 and 1,248 long tons.

Reclaimed rubber prices continued unchanged except for red natural rubber inner tubes, which rose to 22¢ a pound.

Reclaimed Rubber Prices

Whole tire, first line	$0.115
Third line	.1075
Inner tube, black	.17
Red	.22
Butyl	.17
Light carcass	.22
Mechanical, light-colored, medium gravity	.185
Black, medium gravity	.10

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims, in each general group separately featuring characteristic properties of quality, workability, and specific gravity, at special prices.

Scrap Rubber

During the first part of the May 16-June 15 period the scrap rubber market moved along on a fairly even keel, with prices holding pretty much at previously quoted levels. Mixed auto tires at eastern points ranged from $7 to $12.50, the high side applicable only on shipments to Buffalo. Mixed auto tubes were at 6.00¢, both at eastern and midwestern points.

Toward the end of May this market was devoid of any important developments. Market activity continued along at a fair pace with considerable room for improvement, according to trade factors.

Fairly good activity in this market was noted toward the close of the period under review. Some trade quarters indicated business may taper off as the dates for shutdowns for vacation periods in various consuming industries approach.

	Eastern Points	Akron, O.
	Per Net Ton	
Mixed auto tires	$7.00/$12.50	$12.50
S.A.G. truck tires	nom.	17.00
Peeling, No. 1	nom.	33.00
2	nom.	22.00
3	nom.	19.00
Tire buffings	nom.	nom.
	(¢ per Lb.)	
Auto tubes, mixed	6.00	6.00
Black	5.75	5.75
Red	6.25	6.25
Butyl	7.50	7.50

Industrial Fabrics

The industrial fabrics market during the period May 16-June 15 continued to improve somewhat; the tone was more confident although the mills were not especially busy. More inquiries are being received from prospective buyers, and some contract coverings run through the first quarter of 1961. An upturn in business is expected as summer ends since the market is viewed as sound and more alert.

Prices are steadier, but below list or quoted levels. Since minimums have been reached in recent months, an upward movement is expected.

Coaters for automobile producers placed some contracts for third-quarter grey goods, including broken twills and sheetings.

More inquiries for fabrics have been received also from shoe manufacturers.

Buyers right now are covering foreseeable needs and depleting their stocks; so an upturn is looked for.

The second-hand market reports firmer prices and no surpluses in some grades of fabrics.

A card basis chart for ounce, or flat cotton ducks, in effect since 1947, has been revised because of obsolescence since narrow looms had been largely replaced by wider ones.

Industrial Fabrics

Drills*		
59-inch, 1.85, 68x40	yd.	$0.40
2.25, 68x40		.34
Broken Twills*		
54-inch, 1.14, 76x52	yd.	.52
58-inch, 1.06, 76x52		.585
60-inch, 1.02, 76x52		.5825
Osnaburgs*		
40-inch, 2.11, 35x25	yd.	.2275
3.65, 35x25		.1525
59-inch, 2.35, 32x26		.29
62-inch, 2.23, 32x26		.30
Ducks		
Numbered Duck†		
List less 45%		
Enameling Ducks*	S. F.	D. F.
38-inch, 1.78 yd.	$0.3263	.3313
2.00 yd.	.275	.33
51.5-inch, 1.35 yd.	.4738	.4888
57-inch, 1.22 yd.	.4838	.50
61.5-inch, 1.09 yd.	.5413	.5538
Hose and Belting Ducks*		
Basis	lb.	.67
Army Duck†		
52-inch, 11.70 oz., 54x40 (8.10 oz./sq.yd.)	yd.	.5925
Sheeting*		
40-in, 3.15, 64x64	yd.	.2175
3.60, 56x56		.185
52-inch, 3.85, 48x48		.24
57-inch, 3.47, 48x48		.245
60-inch, 2.10, 64x64		.385
2.40, 56x56		.345
Sateens*		
53-inch, 1.12, 96x60	yd.	.645
1.32, 96x64		.575
57-inch, 1.04, 96x60		.615
58-inch, 1.02, 96x60		.7025
1.21, 96x64		.6275
Chafer Fabrics*		
14.40-oz./sq.yd. P.Y.	lb.	.74
11.65-oz./sq.yd. S.Y.		.65
10.80-oz./sq.yd. S.Y.		.68
8.9-oz./sq.yd. S.Y.		.70
40-inch, 2.56, 35x25		.25
60-inch, 1.71, 35x25		.435

* Net 10 days.
† 2% 10 days.

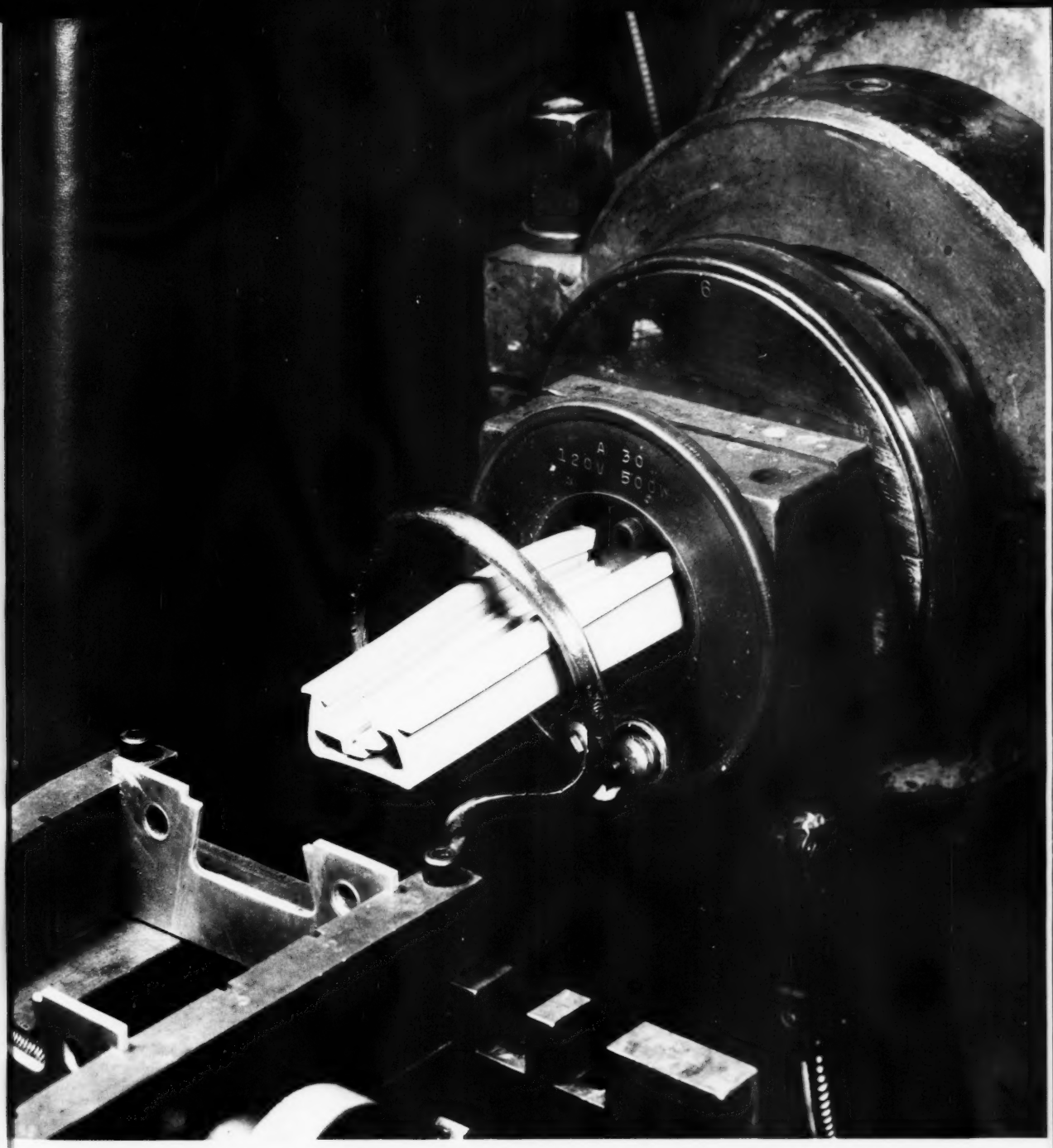
Rayon and Nylon

Tire cord and tire fabric production for the first quarter of this year rose above that of the last quarter of 1959, but was still somewhat below that of the first quarter of 1959, it is reported. Both rayon and nylon production increased, with rayon showing a 3% rate of increase and nylon 8%.

There is still some question as to whether nylon cord tires will invade the original equipment field for 1961.

Du Pont plans to more than double its nylon yarn capacity for tire cord at the Richmond, Va., high-tenacity yarn plant. This year's nylon cord production is expected to be 20% above last year's.

Total packaged production of rayon and acetate filament yarn during May was 59,000,000 pounds, consisting of



POLYSAR KRYNAC 804

Smoother extrusions...cuts down shrinkage

A substantial improvement in the processing of oil-resistant rubber stocks and improved impact strength in PVC or styrene acrylonitrile compounds is now possible through the use of Polysar Krynac 804.

This new Krynac is a cross-linked polymer of butadiene acrylonitrile and divinyl benzene and when used in rubber compounds produces a marked improvement in the processing of extruded, moulded and calendered goods. Dimensional stability is improved and a smoother finish is obtained on extrusions and calendered applications, shrinkage is reduced and problems of die swell are greatly minimized.

For details of POLYSAR KRYNAC 804 write to: Marketing Division, Polymer Corporation Limited, Sarnia, or Polymer's distributor in this area.

*T.M. Registered

POLYSAR

ONE OF THE WORLD'S MAJOR SOURCES OF RUBBER

DISTRIBUTOR FOR THE U.S.A.: H. MUEHLSTEIN & CO., INC., 521 FIFTH AVENUE, NEW YORK 17, N.Y., U.S.A.

POLYSAR
KRYNAC 804 doubles extrusion rate... cuts mill shrinkage by 50%

COMPOUND	A	B	C	D	E
Polysar Krynac 800	100.0	75.0	50.0	25.0	—
Polysar Krynac 804	—	25.0	50.0	75.0	100.0
MILL SHRINKAGE					
Linear shrinkage (with grain) %	45	40	20	10	5
EXTRUSION PROPERTIES					
(A) Garvey Die					
Rate (in. min.)	28	37	50	66	70
Ratio (gm. in.)	4.2	3.3	2.3	1.8	1.7
(B) ⅛" Die					
Rate (in. min.)	150	205	290	365	390
Die swell (%)	120	80	30	5	2

There's a Polysar* rubber for every purpose...General Purpose Rubbers–Butadiene-Styrene Copolymers; Oil Resistant Rubbers–Butadiene-Acrylonitrile Copolymers; Special Purpose Rubbers–Butadiene-Styrene Copolymers; Butyl Rubbers – Isobutylene-Isoprene Copolymers; and Latices.

POLYMER CORPORATION LIMITED SARNIA CANADA
POLYSAR

*Trade Mark Reg'd

Distributors in 43 Countries

POLYMER CORPORATION LIMITED, SARNIA, CANADA

24,800,000 pounds of high-tenacity rayon yarn, and 34,200,000 pounds regular-tenacity.

For April, packaged production of rayon and acetate filament yarn was 56,900,000, consisting of 23,800,000 pounds of high-tenacity rayon yarn and 33,100,000 pounds of regular-tenacity.

End-of May stocks for rayon and acetate filament yarn were: total, 64,400,000 pounds; high-tenacity rayon yarn, 19,500,000 pounds; regular-tenacity, 44,900,000 pounds.

End-of-April stocks were: total, 63,600,000 pounds; high-tenacity rayon yarn, 18,300,000 pounds; regular-tenacity, 45,300,000 pounds.

Filament yarn shipments for May totaled 56,300,000 pounds, consisting of 22,400,000 pounds high-tenacity rayon yarn and 33,900,000 pounds regular-tenacity yarn.

For April, shipments totaled: 54,400,000 pounds, consisting of 21,700,000 pounds' high-tenacity rayon yarn and 32,700,000 pounds' regular-tenacity.

RAYON PRICES

Tire Fabrics

1100/490/2	$0.69
1650/908/2	$0.58/.615

Tire Yarns

High-Tenacity	
1100/ 490	.56
1100/ 980	.57
1150/ 490, 980	.56
1230/ 490	.56
1650/ 980	.49
1875/ 980	.49/ .50
2200/ 980	.48
Super-High Tenacity	
1650/ 720	.50/ .59

NYLON PRICES

Tire Yarns

840/140	.94/.97
1680/280	.91/.94

■

Pelletized News

(Continued from page 118)

807,000 square feet and are expected to begin production by the Summer of 1961. The Milan plant will produce only truck and special tires as soon as the new plants take over production of standard automobile tires.

Mexico's NR Imports Up

Mexico's imports of natural and synthetic rubber continued the upward trend of recent years in 1959 also. The total for the year, excluding latex, came to 29,817 tons, valued at 212,100,000 pesos, which compares with 27,538 tons, value 174,700,000 pesos, for 1958, giving an increase of 8.2% in quantity and 21.4% in value. Anal-

(Continued on page 138)

HOW THE SILICONES MAN KNOWS...

YOUR ONE-SHOT FOAM SURFACTANT IS ALWAYS UNIFORM

Every production batch of UNION CARBIDE L-520 Silicone Surfactant for one-shot polyether foams is thoroughly laboratory tested. This way, your Silicones Man can be sure it is *always uniform in the properties important for foam production.*

Tests are made on a standard one-shot foam formulation. The L-520 must meet minimum requirements for foam rise, settling at the height of the rise, foam uniformity, and freedom from splits.

True, a bench test cannot duplicate the varying production conditions encountered in plants all over the country. But it does assure you of constant uniformity in the significant surfactant properties. It has done much to help bring about widespread acceptance of the one-shot process where once there was hesitation.

For complete data, write Dept. GS-4002, Silicones Division, Union Carbide Corporation, 30 East 42nd St., New York 17, N.Y. *(In Canada:* Union Carbide Canada Limited, Toronto 7.)

UNION CARBIDE SILICONES

Unlocking the secrets of silicones

Rubber, Monomers, Resins, Oils and Emulsions

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Synthetic Rubbers and Latices*

Monomers

11-80, 100, 200, 112-3 Triols	lb.	$0.255		
11-300	lb.	.265		
-400	lb.	.325		
Acrylonitrile	lb.	.27		
Butadiene	lb.	.15		
Dow Styrene	lb.	.12		
H99, N99	lb.	.205		
RG	lb.	.17		
Vinyltoluene	lb.	.17		
Hylene M	lb.	1.25	/	$2.75
M-50	lb.	.86	/	2.36
T	lb.	.85	/	2.41
TM	lb.	.70	/	2.26
-65	lb.	.75	/	2.31
Isobutylene	gal.	.38		
Isoprene	lb.	.25		
Mondur-C	lb.	1.05		
Multron R-2	lb.	.54		
P200	lb.	.23		
Rohm & Haas ethyl acrylate	lb.	.34	/	.36
Glacial methacrylic acid	lb.	.40	/	.425
Methyl acrylate	lb.	.37	/	.39
Methacrylate	lb.	.29	/	.31

Shortstops

4P Mercaptan	lb.	.27	/	.31
DDM	lb.	.94	/	.975
Mercaptan 174	lb.	.38	/	.50
Sharstop 204	lb.	.38	/	.42
268	lb.	.52	/	.53
Tecquinol	lb.	.825	/	.845
Thiostop K	lb.	.50	/	.53
N	lb.	.38	/	.47
Vulnapol KM	lb.	.52	/	.56
NM	lb.	.38	/	.42
Wingstop B	lb.	.38		

Acrylic Types

Acrylon BA-15	lb.			1.25[a]
EA-5	lb.			1.00[a]
Hycar 4021	lb.	1.34[a]	/	1.35[a]

Latices

Hycar 2600X30, 2600X39, 2601	lb.	.50	/	.56

Butadiene Types (BR†)

Cis-1	lb.	.35[b]	/	.50[b]

Cold BR Latex

Pliolite Latex 2104				.325

Fluorocarbon Types

Fluorel KF-2141	lb.	10.00	/	10.25
Kel-F Elastomer	lb.	15.00	/	16.00
5500, 820 (Latex)	lb.	15.00	/	17.15
Viton A, AHV	lb.	10.00	/	10.25
B	lb.	13.00		

Isobutylene Types (IIR)

Enjay Butyl 035, 065, 150, 215, 217, 218, 325				.23[a]
165, 268, 365				.24[a]
Hycar 2202		.65[a]	/	.75[a]
Polysar Butyl 100, 200, 300 400				.245[a]
101				.2775[a]
301				.255[a]
Vistanex LM				.45[a]
MM				.35[a]

Neoprene Types (CR)

Neoprene Type AC, AD, CG	.55[a]	/	.575[a]
FB	.65[a]	/	.675[a]
GN, GN-A, WB, WX	.41[a]	/	.435[a]
GRT, S	.42[a]	/	.445[a]
KNR	.75[a]	/	.775[a]
W, WHV	.39[a]	/	.415[a]
W-M1	.40[a]	/	.415[a]
WRT	.45[a]	/	.475[a]

Latices

Neoprene Latex 571, 842-A	.37[a]	/	.47[a]
572	.39[a]	/	.49[a]
60, 601-A	.40[a]	/	.50[a]
635	.41[a]	/	.51[a]
400, 650	.42[a]	/	.52[a]
735, 736	.38[a]	/	.48[a]
750	.39[a]	/	.49[a]
950	.47[a]	/	.57[a]

Nitrile Types (NBR)

Butaprene NF	.49[b]		
NH	.65[b]		
NL	.50[b]		
NXM	.58[b]		
Chemigum, N1NS	.64[b]		
N3NS, N5	.58[b]		
N6, N-6B, N7, N8	.50[b]		
N600	.50[b]		

Hycar 1001, 1041	$0.58[a]	/	$0.59[a]
1002, 1042, 1043, 1052, 1053, 1312	.50[a]	/	.51[a]
1014	.60[a]	/	.61[a]
1072	.64[a]	/	.65[a]
1411	.62[a]	/	.63[a]
1432, 1441	.59[a]	/	.60[a]
Paracril, AJ	.485[a]	/	.495[a]
B, BJ, BJLT, BLT	.50[a]	/	.51[a]
C, CLT	.58[a]	/	.59[a]
CV	.63[a]	/	.64[a]
D	.65[a]	/	.66[a]
OZO	.46[a]	/	.47[a]
18-80	.60[a]	/	.61[a]
Polysar Krynac 800, 802, 803			.50[a]
801			.58[a]

Latices

Butaprene N-300			.46[b]
N-400, N-401			.54[b]
Chemigum 200			.40[b]
235 CHS, 236			.54[b]
245 B, 245 CHS, 246, 247, 248			.46[b]
Hycar 1512, 1552, 1562, 1577	.45[a]	/	.52[a]
1551, 1561, 1571	.53[a]	/	.60[a]
1852	.46[a]	/	.52[a]
Nitrex 2612	.45[a]	/	.52[a]
2616	.53[a]	/	.60[a]
2619	.52[a]	/	.59[a]
2620, 2625	.45[a]	/	.52[a]
Tylac 640	.45[a]	/	.52[a]
740	.49[a]	/	.56[a]
840	.53[a]	/	.60[a]
1640	.54[a]	/	.61[a]

Polyethylene Type

Hypalon 20	lb.		.4975
30	lb.		.6275
40	lb.		1.5275

Polysulfide Types

Thiokol LP-2, -3, -31, -32, -33			.96[a]
-8			1.35[a]
-205			4.00[a]
Type-A			.50[a]
FA			.69[a]
ST			1.25[a]

Latices

Thiokol Latex (dry wt.) Type MX			.80[a]
WD-2			1.25[a]
-6	.80[a]	/	1.25[a]

Silicone Types

GE (compounded)	2.29[a]	/	4.90[a]
Silicone gum	3.85[a]	/	4.55[a]
Silastic (compounded)	2.95[b]	/	3.50[b]
(Partly compounded)	3.15[b]	/	3.60[b]
(Uncompounded)	4.05[b]	/	4.35[b]
LS-53	12.00	/	16.30
Union Carbide (compounds)	2.35[b]	/	3.20[b]
(Gums)	3.85[b]	/	4.25[b]

Styrene Types (SBR)‡

Hot SBR

Ameripol 1000, 1001, 1006, 1007	.24[a]	/	.247[a]
1002	.2435[a]/		.2495[a]
1006 Crumb	.2475[a]/		.2535[a]
1009	.2475[a]/		.2535[a]
Crumb	.259[a]	/	.265[a]
1011	.2475[a]/		.2535[a]
1012	.2425[a]/		.2485[a]
Crumb	.249[a]	/	.255[a]
1013	.241[a]	/	.247[a]
Crumb	.2615[a]/		.2675[a]
ASRC 1004, 1006	.241[a]	/	.2475[a]
1009	.2475[a]/		.2535[a]
1018	.27[a]	/	.276[a]
1019	.265[a]	/	.271[a]
Copo 1006	.241[a]	/	.247[a]
FR-S 1000, 1001, 1004, 1006	.241[a]	/	.247[a]
1007	.241[a]	/	.247[a]
1009	.2475[a]/		.2535[a]
1010	.26[a]	/	.266[a]
1012	.2425[a]/		.2485[a]
1013	.241[a]	/	.247[a]
Crumb	.2615[a]/		.2675[a]
1014	.281[a]	/	.287[a]
141	.28[a]	/	.286[a]
181	.241[a]	/	.247[a]
Naugapol 1016, 1019	.265[b]	/	.27[b]
1018	.27[b]	/	.275[b]
1021	.30[b]	/	.305[b]
1022	.295[b]	/	.30[b]
1023	.315[b]	/	.32[b]
6003	.27[b]	/	.275[b]
Philprene 1000, 1001, 1006, 6701	.241[b]	/	.247[b]
1009	.2475[b]/		.2535[b]
1018	.27[b]	/	.276[b]
1019	.265[b]	/	.271[b]
Plioflex 1006	.241[a]	/	.247[a]
Polysar S-630	.241[a]	/	.247[a]
S-X-371	.255[a]	/	.261[a]
S-1000, -1006, -1013			.23[a]
-1002, -1011			.2325[a]
-1009			.24[a]
Synpol 1000, 1001, 1006, 1007, 1013, 1061	.241[b]	/	.247[b]
1002	.2435[b]/		.2495[b]
1012	.2425[b]/		.2485[b]
1009	.2475[b]/		.2535
8000	.241[b]	/	.247[b]
X-274	.255[a]	/	.261[a]

Hot SBR Black Masterbatch

Philprene 1100			$0.194
1104			.190[a]
S-1100			.185[a]

Hot SBR Latices

Copo 2000			.2775[a]
FR-S 2000, 2001	$0.2725[a]/		.3425[a]
2002	.35[a]	/	.36[a]
2003, 2004	.305[a]	/	.36[a]
2006	.29[a]	/	.382[a]
Naugatex 2000, 2001	.2775[a]/		.3575[a]
2002	.30[a]	/	.37[a]
2006	.29[a]	/	.42[a]
Pliolite Latex 2000, 2001			.2825
2076			.295[a]
Polysar Latex II			.29[a]
IV			.2775
S-2000, 2006			.26[a]

Cold SBR

Ameripol 1500, 1501, 1502, 4600	.241[a]	/	.247[a]
ASRC 1500, 1502	.241[a]	/	.247[a]
1503	.2625[a]/		.2685[a]
3105, 3106	.241[a]	/	.247[a]
3110	.26[a]	/	.266[a]
C-102			.23[a]
Copo 1500, 1502, 1507	.241[a]	/	.247[a]
1505-NS	.261[a]	/	.267[a]
FR-S 1500, 1502, 146, 179	.241[a]	/	.247[a]
127	.26[a]	/	.266[a]
Gentro 1500			.241
Naugapol 1503	.2625[b]/		.2675[b]
1504	.33[b]	/	.335[b]
6100	.31[b]	/	.315[b]
Philprene 1500, 1502	.241[b]	/	.247[b]
1503	.2625[b]/		.2685[b]
Plioflex 1500C, 1502, 1507, 1510	.241[a]	/	.247[a]
Polysar Kryflex 200			.251[a]
252			.27[a]
Krylene NS			.241[a]
SS-250, SS-250-Flake			.2875[a]
S-1500, S-1502			.23[a]
1509			.23[a]
Synopol 1500, 1502, 1551, 8103	.241[b]	/	.247[b]

Cold SBR Black Masterbatch

Ameripol 1605	.19[a]	/	.196[a]
4651	.177[a]	/	.183[a]
4659	.182[a]	/	.188[a]
4660	.187[a]	/	.193[a]
Baytown 1600, 1601, 1602			.193[b]
Carbomix 3750	.182[a]	/	.188[a]
3752	.1845[a]/		.1905[a]
3756	.1569[a]/		.1629[a]
CB-102			.185[a]
Gentro-Jet 9152			.208
9153			.182
9154			.1845
Philprene 1601	.193[b]	/	.199[b]
1603	.196[b]	/	.202[b]
1605	.19[b]	/	.196[b]
S-1600, -1602			.1825[a]
-1605			.18[a]
S-1600, -1602, -1604			.1825[a]
-1605			.18[a]
-1606, -1607			.175[a]
-7652			.1875[a]
OB-116			.181[a]
Synpol 8151	.182[b]	/	.188[b]
8152	.186[b]	/	.192[b]

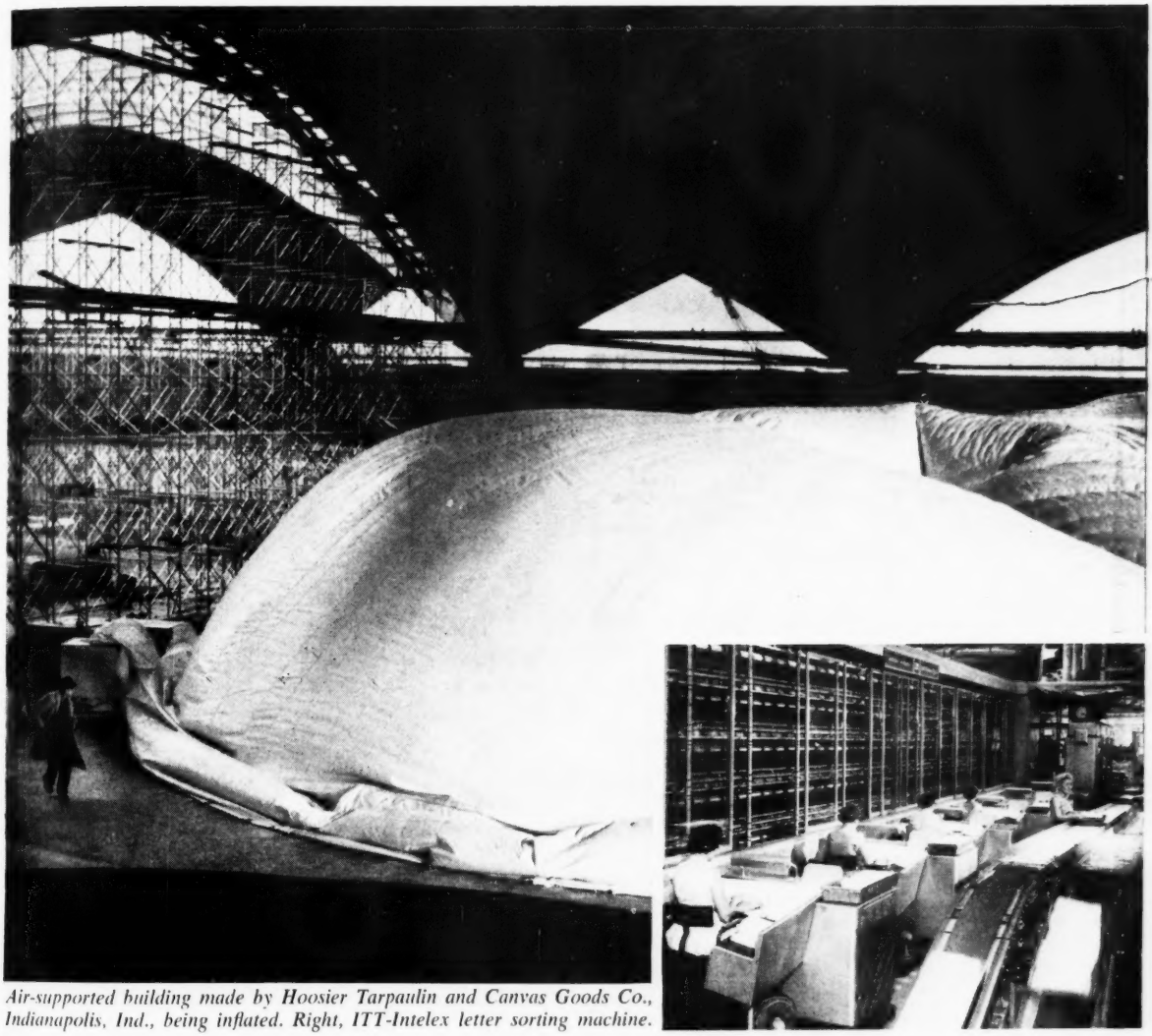
Cold SBR Oil Masterbatch

Ameripol 1705	.2035[a]/		.2095[a]
1707, 1708	.191[a]	/	.197[a]
1710, 1712	.1885[a]/		.1945[a]
4700	.175[a]	/	.181[a]
4701	.1725[a]/		.1785[a]
ASCR 1703	.206[a]	/	.212[a]
1708	.191[a]	/	.197[a]
1712	.1885[a]/		.1945[a]
1713	.175[a]	/	.181[a]
Copo 1712	.1885[a]/		.1945[a]
1713	.175[a]	/	.181[a]
1714	.1725[a]/		.1785[a]
1773	.206[a]	/	.212[a]
1778	.191[a]	/	.197[a]
FR-S 1703	.206[a]	/	.212[a]
1710	.1885[a]/		.1945[a]
1712	.1885[a]/		.1945[a]
123	.196[a]	/	.202[a]
154, 155	.1885[a]/		.1945[a]
173	.206[a]	/	.212[a]
178	.191[a]	/	.197[a]
Gentro 1712			.1885
Philprene 1703	.206[b]	/	.212[b]
1708	.191[b]	/	.197[b]
1712	.1885[b]/		.1945[b]
Plioflex 1703, 1773	.206[a]	/	.212[a]
1710C, 1712C	.1885[a]/		.1945[a]
1713	.175[a]	/	.181[a]
1714C	.1725[a]/		.1785[a]
1773	.206[a]	/	.212[a]
1778	.191[a]	/	.197[a]
Polysar Krynol 651			.1885[a]
652			.191[a]
S-1703			.195[a]
-1707			.18[a]
-1709, -1710, -1712			.1775[a]
-1778			.18[a]
Synpol 1703	.206[b]	/	.212[b]
1707, 1708	.191[b]	/	.197[b]
1712	.1885[b]/		.1945[b]

(Continued on page 138)

[a] Freight extra.
[b] Minimum freight allowed.
[c] Freight prepaid.
* Prices are per pound carload of tank-car dry weight unless otherwise specified.
† BR—Butadiene rubber.
‡ SBR—Styrene-butadiene rubber.

Huge fabric building speeds construction of first push-button post office



Air-supported building made by Hoosier Tarpaulin and Canvas Goods Co., Indianapolis, Ind., being inflated. Right, ITT-Intelex letter sorting machine.

The world's first fully mechanized post office—a "laboratory for the future" which promises to revolutionize mail handling—is scheduled for completion in Providence, R. I. this October.

To meet this deadline, sensitive electro-mechanical machinery for sorting letters at high speeds had to be installed even before the walls of the building went up. The problem: How to protect it during installation?

Answer: They erected a building within a building. A huge fabric air-supported structure—one of the largest of its kind—was fabricated for International Telephone and Telegraph.

The base fabric selected for this vital job was Wellington Sears Welkote, a tough nylon, coated with vinyl by Sawyer Coated Fabrics, Division of Farrington Texol Corp., Watertown, Mass.

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Compounding Ingredients*

Abrasives

Pumicestone, powdered	lb.	$0.0363	$0.065
Rottenstone, domestic	lb.	.03 /	.04
Shelblast	ton	80.00 /	165.00
Walnut Shell Grits	ton	50.00 /	160.00

Accelerators

A-1 (Thiocarbanilide)	ton	.74 /	.81
A-32	ton	.66 /	.80
A-100	lb.	.52 /	.66
Accelerator B	lb.	.92	
49	lb.	.59 /	.60
52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	4.25	
89	lb.	1.20	
108	lb.	.92	
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.54 /	.56
Amax	lb.	.75 /	.77
No. 1	lb.	.71 /	.73
Arazate	lb.	2.25	
Beutene	lb.	.66 /	.68
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butazate	lb.	1.04	
Butyl Eight	lb.	1.10 /	1.35
Namate	lb.	.45 /	.50
Zimate	lb.	1.04	
Ziram	lb.	.89 /	1.04
Captax	lb.	.44 /	.46
Conac S	lb.	.76 /	.78
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Cydac	lb.	.71 /	.73
Cyuram DS, powder	lb.	1.14	
Pellets	lb.	1.14	
MS, powder	lb.	1.14	
Pellets	lb.	1.14	
Cyzate B, E	lb.	.87 /	.89
Delac-S	lb.	.71 /	.73
DIBS	lb.	.85 /	.87
Dipac	lb.	.85	
DOTG (diorthotolylguanidine)			
Cyanamid	lb.	.69 /	.70
Du Pont	lb.	.69 /	.70
DPG (diphenylguanidine)			
Cyanamid	lb.	.49 /	.50
Monsanto	lb.	.49 /	.50
El-Sixty	lb.	.62 /	.64
Ethazate	lb.	1.04	
50-D	lb.	.87 /	.89
Ethyl Seleram	lb.	3.00	
Thiurad	lb.	1.04	
Thiuram	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04	
Zimate	lb.	1.04	
Ziram	lb.	.89 /	1.04
Ethylac #650	lb.	.93 /	.95
Guantal	lb.	.62 /	.64
Hepteen Base	lb.	1.85	
Ledate	lb.	1.04	
MBT (2-mercaptobenzothiazole)			
American Cyanamid	lb.	.44 /	.46
Du Pont	lb.	.44 /	.46
Naugatuck	lb.	.44 /	.49
-XXX, Cyanamid	lb.	.55 /	.57
MBTS (mercaptobenzothiazyl disulfide)			
Cyanamid	lb.	.54 /	.56
Du Pont	lb.	.54 /	.56
Naugatuck	lb.	.54 /	.56
-W Cyanamid	lb.	.59 /	.61
Merac #225	lb.	.75 /	1.05
Mertax	lb.	.55 /	.57
Methazate	lb.	1.04	
Methyl Thiuram	lb.	1.14	
Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14	
Mono-Thiurad	lb.	1.14	
2-MT (2-mercaptothiazoline)			
Cyanamid	lb.	.88 /	.90
Du Pont	lb.	1.00	
NA-22	lb.	1.05	
NOBS No. 1	lb.	.71 /	.73
Special	lb.	.75 /	.77
O-X-A-F	lb.	.55 /	.57
Pennac SDB	lb.	.45 /	.48
Pentex	lb.	1.24	
Flour	lb.	.30	
Permalux	lb.	2.25	
Phenex	lb.	.52 /	.59
Pip-Pip		2.07	
Polyac Pellets	lb.	1.85	
R-2 Crystals	lb.	4.35	
Rotax	lb.	.55 /	.57
RZ-50, -50B	lb.	1.00	
S.A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	3.00	
Santocure	lb.	.71 /	.73
NS	lb.	.71 /	.73
Selenacs	lb.	3.00	
SPDX-GH	lb.	.69 /	.74
GL	lb.	1.20 /	1.34
Sulfads	lb.	1.98	
Tellurac	lb.	1.30 /	1.55
Tepidone	lb.	$0.45	
Tetrone A	lb.	1.98	
Thiates	lb.	.88 /	$1.25
Thiofide	lb.	.54 /	.56
Thionex	lb.	1.14	
Thiotax	lb.	.44 /	.46
Thiurad	lb.	1.14	
Thiuram E	lb.	1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	.58
Base	lb.	1.03 /	1.06
Tuex	lb.	1.14	
Ultex	lb.	1.00 /	1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB		.45	
NS	lb.	.75 /	1.05
T.M.D.	lb.	1.14	
ZB, ZE, ZM	lb.	.85 /	.89
Z-B-X	lb.	2.45	
Zenite	lb.	.54 /	.56
A	lb.	.69 /	.71
AM	lb.	.76 /	.78
Special	lb.	.55 /	.57
Zetax	lb.	.55 /	.57
Zimate	lb.	1.04	
ZMBT	lb.	.55 /	.57

Accelerator-Activators, Inorganic

Lime, hydrated	ton	21.96	
Litharge, comml.	lb.	.1425/	.1575
Eagle, sublimed	lb.	.1535	
National Lead, sublimed	lb.	.1585	
Red lead, comml.	lb.	.185 /	.195
Eagle	lb.	.1575	
National Lead	lb.	.1625/	.1645
PRD-90	lb.	.38 /	.50
White lead, carbonate	lb.	.19 /	.20
Eagle	lb.	.17 /	.18
National Lead	lb.	.18 /	.19
Silicate	lb.	.1725/	.1825
Eagle	lb.	.1475/	.22
National Lead	lb.	.165 /	.175
Zinc oxide, comml.†	lb.	.145 /	.155

Accelerator-Activators, Organic

Aktone	lb.	.2125/	.2325
Barak	lb.	.65	
Capital 170	lb.	.20 /	.25
171	lb.	.1425/	.1925
225, 258, 710	lb.	.14 /	.19
261	lb.	.155 /	.18
262	lb.	.16 /	.185
263	lb.	.1775/	.2025
270	lb.	.1175/	.1425
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Emery 600	lb.	.1325/	.1825
G-M-F	lb.	2.60 /	2.65
PDD-70	lb.	2.70 /	3.00
PGD-25	lb.	1.25 /	1.50
Groco 30	lb.	.1325/	.1825
Guantal	lb.	.62 /	.64
Hyfac 410	lb.	.1425/	.1675
430	lb.	.18 /	.205
431	lb.	.2025/	.2275
Hystrene S-97	lb.	.1863/	.2125
T-45	lb.	.1638/	.19
T-70	lb.	.1738/	.20
Industrene B	lb.	.1263/	.1525
R	lb.	.1138/	.14
158	lb.	.1313/	.1575
254	lb.	.1413/	.1675
262	lb.	.1513/	.1775
Laurex	lb.	.37 /	.39
MODX	lb.	.295 /	.345
NA-22	lb.	1.05	
PND-70	lb.	1.35 /	1.60
Oleic acid, comml.	lb.	.185 /	.225
Emersol 210 Elaine	lb.	.1375/	.1875
Groco 2, 4, 8, 18	lb.	.1375/	.1875
Welcoline	lb.	.21 /	.42
Plastone	lb.	.27 /	.30
Polyac	lb.	1.85	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485/	.1703
Stearex Beads	lb.	.1488/	.1588
Stearic acid			
Emersol 120	lb.	.1575/	.1825
150	lb.	.185 /	.21
Hydrofoil 51	lb.	.09	
Hydrogenated, rubber grd.			
Groco 56	lb.	.115 /	.14
Rufat 75	lb.	.1062/	.1325
Single pressed, comml.	lb.	.1475/	.1675
Emersol 110	lb.	.1525/	.1775
Groco 53	lb.	.1525/	.1775
Wilmar 253	lb.	.1525/	.1775
Double pressed, comml.	lb.	.1525/	.1725
Groco 54	lb.	.1575/	.1825
Wilmar 254	lb.	.1575/	.1825
Triple pressed, comml.	lb.	.175 /	.195
Groco 55	lb.	.175 /	.20
Wilmar 255	lb.	.1875/	.2075
Sterene 60-R	lb.	.09 /	.1075
Tonox	lb.	.54 /	.56
Vimbra	lb.	.32 /	.385
Vulklor	lb.	.88 /	.98
Wilmar 110	lb.	.17 /	.22
434	lb.	.1425/	.1925
Zinc stearate, comml.	lb.	.39 /	.44

Antioxidants

AgeRite Alba	lb.	$2.40 /	$2.50
Gel	lb.	.70 /	.72
H. P.	lb.	.79 /	.81
Hipar	lb.	1.05 /	1.07
Powder	lb.	.57 /	.59
Resin	lb.	.88 /	.90
D	lb.	.57 /	.59
Spar	lb.	.57 /	.59
Stalite	lb.	.57 /	.59
S	lb.	.57 /	.59
Superlite	lb.	.57 /	.59
White	lb.	1.50 /	1.60
Akroflex C	lb.	.85 /	.87
CD	lb.	.79 /	.81
Albasan	lb.	.69 /	.73
Alcogard 354 Powder	lb.	1.50 /	1.52
Allied AA 1144	lb.	.23 /	.24
AA-1177	lb.	.155 /	.165
Aminox	lb.	.57 /	.59
Antioxidant 425	lb.	2.47 /	2.50
2246	lb.	1.50 /	1.53
Antisol	lb.	.23 /	.24
Antisun	lb.	.15 /	.51
Antox	lb.	.59 /	.61
Aranox	lb.	3.25	
Betanox Special	lb.	.94 /	.96
B-L-E, -25	lb.	.57 /	.59
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.55 /	.60
CAO-1	lb.	.37 /	.86
-5	lb.	1.49 /	1.63
Copper Inhibiter X-872-L	lb.	2.01	
D-B-P-C	lb.	.91 /	1.16
Deenax	lb.	.95	
Flectol H	lb.	.57 /	.59
Flexamine	lb.	.79 /	.81
Heliozone	lb.	.31 /	.32
Ionol	lb.	.91 /	1.65
Microflake	lb.	.20 /	.24
Naugawhite	lb.	.57 /	.59
NBC	lb.	1.67	
Neozone A	lb.	.64 /	.66
C	lb.	.86 /	.88
D, Special	lb.	.57 /	.59
Nevastain A	lb.	.51 /	.61
B	lb.	.51 /	.70
Nonox CI	lb.	1.50 /	1.67
WSL	lb.	1.50 /	1.60
WSP	lb.	1.47 /	1.60
Octamine	lb.	.57 /	.59
PDA-10	lb.	.46 /	.48
Pennox A, C, D	lb.	.57 /	.59
B	lb.	.67 /	.69
Permalux	lb.	2.25	
Polygard	lb.	.57 /	.59
Polylite	lb.	.55 /	.60
Protector	lb.	.41	
Rio Resin	lb.	.70 /	.72
Santoflex			
75	lb.	1.01 /	1.03
AW	lb.	.71 /	.73
DD	lb.	.57 /	.59
Santovar A	lb.	1.55 /	1.57
Santowhite Crystals, Powd.	lb.	1.55 /	1.57
L	lb.	.57 /	.59
MK	lb.	1.25 /	1.27
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.52 /	.60
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite #100	lb.	.21 /	.23
#127	lb.	.17 /	.19
Sunproof-713	lb.	.26 /	.27
Improved	lb.	.25 /	.26
Jr.	lb.	.22 /	.23
Tenamene 3	lb.	.91 /	1.05
Thermoflex A	lb.	1.05 /	1.07
Tonox	lb.	.54 /	.59
Velvapex 51-250	lb.	.40	
V-G-B	lb.	.75 /	.80
Zalba	lb.	1.10	
Zenite	lb.	.52 /	.54

Antiozonants

Eastozone 30, 31	lb.	1.05 /	1.09
32	lb.	1.15 /	1.20
Flexone 3-C	lb.	2.00	
6-H	lb.	1.25 /	1.27
Nonox ZA	lb.	1.99 /	2.00
Santoflex AW	lb.	.71 /	.73
Tenamene 30, 31	lb.	1.24 /	1.28
Tysonite	lb.	.30 /	.307
UOP 88, 288	lb.	1.05 /	1.07
Wing-Stay S, T	lb.	.55 /	.67
100	lb.	1.00 /	1.08

Antiseptics

Copper naphthenate, 6-8%	lb.	.245	
Pentachlorophenol	lb.	.22 /	.30
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

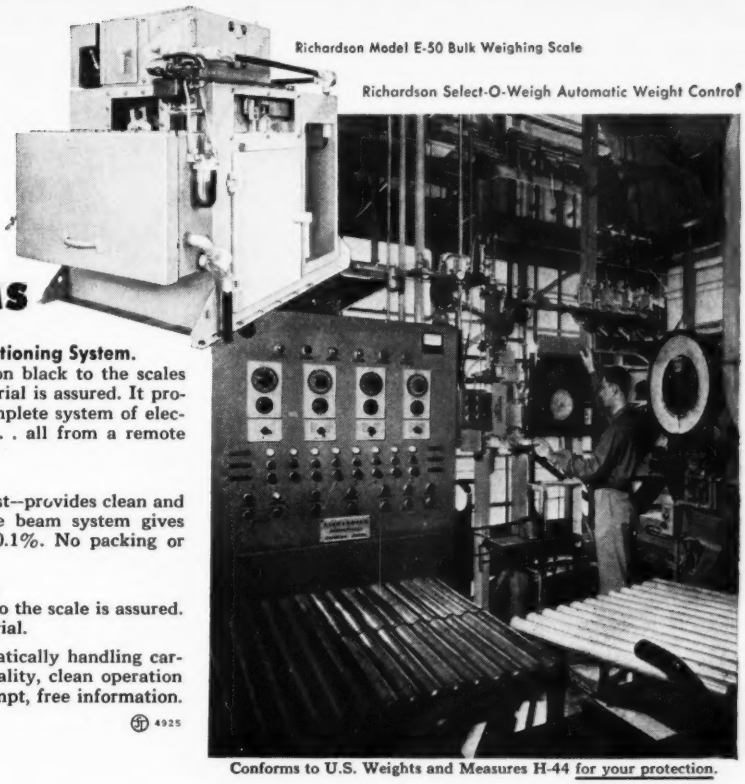
Blowing Agents

Ammonium bicarbonate	lb.	.07 /	.09
Carbonate	lb.	.16	

* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.

† For trade names, see Color—White, Zinc Oxides.

HOW Richardson Solves CARBON BLACK HANDLING PROBLEMS



Richardson Model E-50 Bulk Weighing Scale

Richardson Select-O-Weigh Automatic Weight Control

. . . With The Richardson Select-O-Weigh Proportioning System.
Fully automatic control of feeding of carbon black to the scales and efficient, accurate weighing of the material is assured. It provides accuracy and reliability through a complete system of electronic checks on each phase of handling . . . all from a remote location if desired.

. . . With The Richardson E-50 Bulk Scale.
This completely enclosed unit eliminates dust—provides clean and healthy working conditions. The knife-edge beam system gives positive accuracy of each weighing to ± 0.1%. No packing or caking of material on inside walls.

. . . With The Specially Designed Screw Feeders.
Constant and uniform flow of carbon black to the scale is assured. No flushing, jamming or dusting of the material.

A Richardson Select-O-Weigh system for automatically handling carbon black is the answer to improved product quality, clean operation and lower production costs. Call or write for prompt, free information.

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Richardson
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Also manufactured in Europe to U.S. standards

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TEXTILE PROOFERS INC.

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MORE THAN THIRTY YEARS OF EXPERIENCE AND SERVICE

Blowing Agent 8110S	lb.	$0.32	/ $0.35
Celogen	lb.	1.95	
-80	lb.	1.60	
-AZ	lb.	1.92	
Kempore R-125	lb.	1.92	
Opex 40	lb.	.72	
PL-80	lb.	1.44	
Sodium bicarbonate	100 lbs.	2.55	/ 3.85
Carbonate, tech.	100 lbs.	1.35	/ 5.52
Sponge Paste	lb.	.20	
Unicel ND	lb.	.72	
NDX	lb.	1.44	
S	lb.	.20	
Vulcacel BN	lb.	1.36	/ 1.51
BMC	lb.	.68	/ .79

Bonding Agents

Braze	gal.	6.00	/ 9.00
Cover cement	gal.	2.50	/ 4.00
Chemlok 201, 203	gal.	5.00	/ 7.50
220	gal.	9.25	/ 12.00
401	gal.	11.70	/ 14.40
602	gal.	25.00	/ 26.00
607	gal.	18.00	
614	lb.	4.35	/ 4.75
Flocking Adhesive RFA17, RFA22, RFA25	lb.	.50	
G-E Silicone Paste SS-15	lb.	4.52	/ 5.10
SS-64	lb.	3.65	/ 6.75
-67 Primer	lb.	7.50	/ 12.50
Gen-Tac Latex	lb.	.70	/ .805
Hylene M	lb.	1.25	/ 2.75
M-50	lb.	.86	/ 2.36
Kalabond Adhesive	gal.	6.50	/ 10.00
Tie Cement	gal.	2.00	/ 5.60
Thixons	gal.	1.48	/ 12.00
Ty Ply, BN, Q, S, UP, 3640	gal.	6.75	/ 8.00
BC	gal.	4.50	/ 6.00
RC	gal.	3.75	/ 5.00

Brake Lining Saturants

BRT 3	lb.	.018	/ .0265
Resinex L-S	lb.	.0225/	.03

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	.26	/ .35
Kosmos/Dixie BB	lb.	.23	/ .30
Texas MC-74-BD	lb.	.26	/ .35
Voltex	lb.	.18	/ .315

Easy Processing Channel—EPC

Continental AA	lb.	.0775/	.155
Kosmobile 77/Dixiedensed 77	lb.	.074	/ .1225
Micronex W-6	lb.	.08	/ .1625
Spheron #9	lb.	.085	/ .1625
Texas E	lb.	.08	/ .1625
Witco #12	lb.	.0775/	.155
Wyex EPC	lb.	.08	/ .1625

Medium Processing Channel—MPC

Arrow MPC	lb.	.08	/ .1625
Continental A	lb.	.0775/	.155
Kosmobile S-66/Dixiedensed S-66	lb.	.0775/	.145
Micronex Standard	lb.	.08	/ .1625
Spheron #6	lb.	.085	/ .1625
Texas M	lb.	.08	/ .1625
Witco #1	lb.	.0775/	.155

Conductive Furnace—CF

Aromex CF	lb.	.0875/	.155
Continex CF	lb.	.11	/ .17
Vulcan C	lb.	.110	/ .185
SC	lb.	.18	/ .255
XC-72	lb.	.25	/ .34

Fast Extruding Furnace—FEF

Arovel FEF	lb.	.0625/	.135
Continex FEF	lb.	.0675/	.135
Kosmos 50/Dixie 50	lb.	.06	/ .10
Philblack A	lb.	.0675/	.135
Statex M	lb.	.0625/	.135
Sterling SO	lb.	.0675/	.135

Fine Furnace—FF

Statex B	lb.	.0675/	.14
Sterling 99	lb.	.0725/	.14

High Abrasion Furnace—HAF

Aromex HAF	lb.	.0725/	.145
Continex HAF	lb.	.0775/	.145
Kosmos 60/Dixie 60	lb.	.079	/ .1175
Philblack O	lb.	.0775/	.145
Statex R	lb.	.0725/	.145
Vulcan #3	lb.	.0775/	.145

Intermediate Super Abrasion Furnace—ISAF

Aromex ISAF	lb.	.0875/	.16
Continex ISAF	lb.	.0925/	.16
Kosmos 70/Dixie 70	lb.	.10	/ .045
Philblack I	lb.	.0925/	.16
Statex 125	lb.	.0875/	.16
Vulcan 6	lb.	.0925/	.16

General-Purpose Furnace—GPF

Arogen GPF	lb.	.055	/ .1275
Continex GPF	lb.	.06	/ .1275
Statex G	lb.	.055	/ .1275
Sterling V	lb.	.06	/ .1275
Non-staining	lb.	.06	/ .1275

High Modulus Furnace—HMF

Continex HMF	lb.	$0.0625/	$0.13
Kosmos 40/Dixie 40	lb.	.055 /	.095
Modulex HMF	lb.	.0625/	.13
Statex 93	lb.	.0575/	.13
Sterling L, LL	lb.	.0625/	.13

Semi-Reinforcing Furnace—SRF

Continex SRF	lb.	.0575/	.125
Essex SRF	lb.	.0525/	.125
Furnex	lb.	.0525/	.125
Gastex	lb.	.0625/	.135
Kosmos 20/Dixie 20	lb.	.0575/	.0775
Pelletex, NS	lb.	.0575/	.125
Regal	lb.	.0575/	.125
Sterling NS, S	lb.	.0575/	.125
R	lb.	.0625/	.135

Super Abrasion Furnace—SAF

Philblack E	lb.	.115 /	.19
Statex 160	lb.	.11 /	.19
Vulcan 9	lb.	.115 /	.19

Fine Thermal—FT

P-33	lb.	.0575/	.0625
Sterling FT	lb.	.0625	

Medium Thermal—MT

Sterling MT	lb.	.045	
Non-staining	lb.	.055	
Thermax	lb.	.04 /	.045
Stainless	lb.	.05 /	.055

Awaiting Classification

Regal 300	lb.	.0775/	.145
600	lb.	.0925/	.16

Colors

Black

Iron oxides, comml.	lb.	.1235/	.135
BK—Lansco	lb.	.1275/	.13
Williams	lb.	.145	
Lansco synthetic	lb.	.10	
Mapico pure synthetic	lb.	.1475/	.15
Lampblack, comml.	lb.	.16 /	.45
Superjet	lb.	.085 /	.12
Permanent Blue	lb.	.80 /	1.05
Stan-Tone	lb.	.45 /	1.20
Vansul masterbatch	lb.	.60 /	.65
Paste	lb.	.14 /	.15

Blue

Alkali Blue G, R	lb.	2.38	
C. P. Iran Blues	lb.	.52 /	.54
Du Pont	lb.	2.55 /	4.75
Filo	lb.	.28	
Heveatex pastes	lb.	.80 /	1.45
Lansco ultramarines	lb.	.25 /	.28
Monsanto Blue 7	lb.	1.55	
11	lb.	3.45	
DPB-283	lb.	1.93	
S-11	lb.	2.05	
Permanent Blue	lb.	.80 /	1.05
Solfast	lb.	1.60 /	3.25
Stan-Tone Violet Blue D-4000	lb.	3.45	
4001	lb.	3.00	
4002	lb.	.90	
4900	lb.	1.97 /	2.15
Vansul masterbatch	lb.	.90 /	2.70

Brown

Filo	lb.	.13	
Iron oxides, comml.	lb.	.1425/	.145
Lansco synthetic	lb.	.125	
Mapico Brown	lb.	.1575/	.16
Sienna, burnt, comml.	lb.	.0425/	.155
Williams	lb.	.115 /	.1775
Raw, comml.	lb.	.045 /	.1325
Williams	lb.	.08 /	.1725
Umber, burnt, comml.	lb.	.06 /	.07
Williams	lb.	.0725/	.085
Raw, comml.	lb.	.0625/	.07
Williams	lb.	.07 /	.0825
Williams, pure brown	lb.	.155	
Vandyke	lb.	.12	
Mapico Tan	lb.	.2325/	.235
Metallic brown pure synthetic	lb.	.05 /	.06
Vansul masterbatch	lb.	2.10 /	2.20

Green

Chrome	lb.	.42 /	.45
Green	lb.	.80 /	2.40
Oxide	lb.	.3925/	1.10
Cyanamid	lb.	.42 /	.45
Green G	lb.	3.00	
Lincoln Green	lb.	5.30 /	6.60
G-4099-6099	lb.	.4525	
GH-9869	lb.	1.10 /	1.25
9976	lb.	1.20 /	1.35
Du Pont	lb.	2.05 /	2.80
Filo	lb.	.40	
Heveatex pastes	lb.	.95 /	1.85
Lansco Toner	lb.	1.35	
Monsanto Green 3	lb.	2.75	
14	lb.	1.45	
17	lb.	3.95	
71205	lb.	1.35	
DGP	lb.	2.03	
S-17	lb.	2.25	

‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

Permansa	lb.	$1.45	
Serene	lb.	3.50	
Solfast	lb.	1.60	/ $1.35
Stan-Tone D-5000	lb.	3.95	
5001	lb.	.82	
5400	lb.	1.50	
Vansul masterbatch	lb.	2.00	/ 2.60

Orange

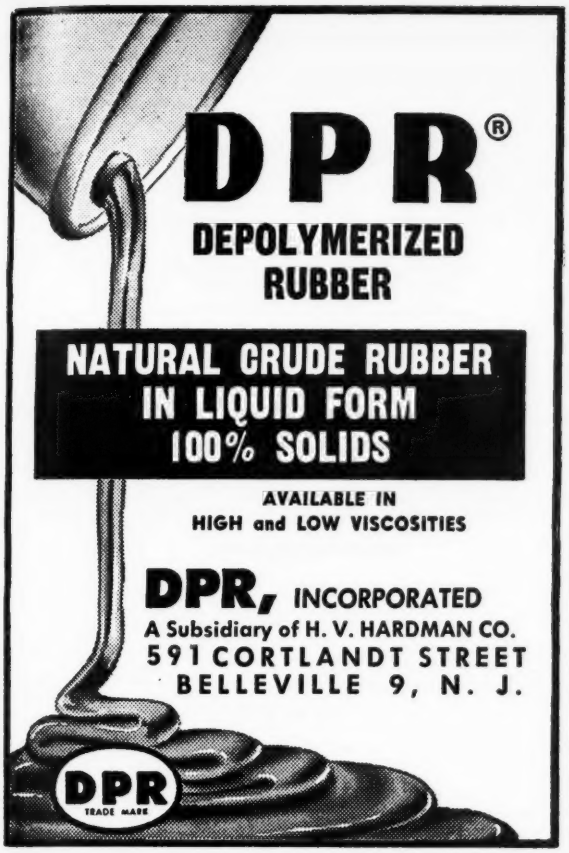
Benzidine 12193	lb.	3.30	
Cyanamid Permatons	lb.	1.56	
Dianisidine 10406	lb.	2.85	
Du Pont	lb.	2.25	
Molybdate	lb.	.49	
Monsanto Orange 68187	lb.	2.90	
Stan-Tone Light orange 70 PCO3	lb.	2.48	/ 2.76
D-7003	lb.	3.97	/ 4.17
Orange 70 PCO4	lb.	2.80	/ 3.08
D-7004	lb.	4.23	/ 4.43
7104	lb.	1.85	/ 2.05
Vansul masterbatch	lb.	2.00	/ 2.60

Red

Antimony trisulfide	lb.	.285	/ .315
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Arcturus CP-1270	lb.	1.35	
Brilliant Toning Red	lb.	.77	/ 1.90
Cadmium red lithopones	lb.	2.21	/ 3.77
Cadmolith	lb.	1.72	/ 2.20
Cyanamid	lb.	.91	/ 2.00
Naphthol Red, Scarlet	lb.	2.95	/ 3.80
Du Pont	lb.	2.00	/ 2.05
Filo	lb.	.11	
Indian Red	lb.	.1275	
Iron oxide, comml.	lb.	.06	/ .13
Lansco synthetic	lb.	.1175	
Mapico pure synthetic	lb.	.1425/	.145
Recco	lb.	.12	
Williams Red	lb.	.13	/ .1525
Lake Red C, CP-1104	lb.	1.25	
Monsanto Maroon 113	lb.	1.50	
61148	lb.	1.75	
Red 7	lb.	1.55	
41	lb.	4.40	
3501	lb.	1.15	
4004	lb.	1.50	
69191	lb.	3.38	
Autumn	lb.	1.10	
PRP-285	lb.	1.27	
S-44	lb.	1.28	
Plasticone	lb.	1.02	/ 4.60
Rub-Er-Red	lb.	.0975	
Solfast	lb.	1.60	/ 1.80
Stan-Tone 70 PCO5	lb.	3.00	/ 3.28
D-2000	lb.	1.25	
2110, 2120, 2121	lb.	.98	
2200	lb.	1.47	
2500	lb.	1.90	
2600	lb.	4.60	
2601	lb.	1.60	
2700	lb.	1.75	
2800	lb.	1.90	
Light Red D-7005	lb.	4.68	/ 4.88
7105	lb.	1.97	/ 2.17
Red 70 PCO6	lb.	3.35	/ 3.63
D-7006	lb.	4.89	/ 5.09
-7106	lb.	2.20	/ 2.40
Vansul masterbatch	lb.	.95	/ 3.30
Venetian	lb.	.04	/ .0675

White

Antimony oxide	lb.	.27	/ .285
Burgess Iceberg	ton	50.00	/ 80.00
Cryptone BT	lb.	.10	/ .11
Permolith lithopone	lb.	.0825/	.0912
Titanium pigments			
Horse Head Anatase	lb.	.255	/ .27
Rutile	lb.	.275	/ .29
Rayox LW	lb.	.195	/ .205
R-110	lb.	.215	/ .225
Ti-Cal	lb.	.075	/ .0825
Ti-Pure	lb.	.195	/ .225
Titanox A, AA, A-168	lb.	.255	/ .265
C-50	lb.	.1438/	.1488
RA, -10, -50	lb.	.275	/ .285
RC	lb.	.0963/	.1013
-HT, -HTX	lb.	.0963/	.0988
Rutile	lb.	.205	/ .29
Unitane	lb.	.255	/ .29
Zopaque Anatase	lb.	.245	/ .27
Zinc oxide, comml.	lb.	.145	/ .1825
Azo ZZZ-11, -44, -55	lb.	.145	/ .155
12% leaded	lb.	.125	/ .135
35% leaded	lb.	.15375/	.16375
50% leaded	lb.	.1575/	.1675
Eagle AAA, lead free	lb.	.145	/ .155
5% leaded	lb.	.145	/ .155
35% leaded	lb.	.15375/	.16375
50% leaded	lb.	.1575/	.1675
Florence Green Seal	lb.	.1625/	.1725
Red Seal	lb.	.1575/	.1675
White Seal	lb.	.1675/	.1775
Horsehead XX-4, -78	lb.	.145	/ .155
Kadox-15, -17, -72, -515	lb.	.145	/ .155
-25	lb.	.15	/ .16
Lehigh, 35% leaded	lb.	.15375/	.16375
50% leaded	lb.	.1575/	.1675
Protox-166, -167	lb.	.145	/ .155
St. Joe, lead free	lb.	.145	/ .175
Zinc sulfide, comml.	lb.	.253	/ .263
Cryptone ZS	lb.	.253	/ .263



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Used as a compounding agent in the manufacture of mechanical rubber goods and general sundries, Claremont Flock Fillers provide reinforcement, improve tear and abrasion resistance. Claremont flock finishes for rubber fabrics provide a wide range of appealing textures that are uniform and long-wearing. In many applications the proper use of a Claremont flock will substantially reduce production costs.

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CLAREMONT FLOCK CORPORATION
CLAREMONT, NEW HAMPSHIRE
The Country's Largest Manufacturer of Flock

Yellow

Benzidine 12199	lb.	$0.58 /	$2.55
Cadmium yellow lithopones	lb.	1.12 /	1.15
Cadmolith	lb.	1.12 /	1.20
Chrome	lb.	.135 /	.145
Cyanamid Hansa Yellow	lb.	2.20	
Du Pont	lb.	2.25	
Filo	lb.	.10	
Iron oxide, comml	lb.	.0525 /	.1175
Lansco synthetic	lb.	.1075	
Mapico pure synthetic	lb.	.12 /	.1275
Williams	lb.	.115 /	.1225
Lightfast Benzidine 12220	lb.	3.40	
Monsanto Yellow 14	lb.	1.91	
10010	lb.	1.91	
BYP-282	lb	1.21	
GA	lb.	2.45	
S-10010	lb.	1.17	
Stan-Tone			
D-1100	lb.	2.55	
1101	lb.	.69	
Lemon 70 PCO1	lb.	1.77 /	2.19
D-7001	lb.	2.80 /	3.00
Medium yellow 70 PCO2	lb.	1.79 /	2.21
D-7002	lb.	2.98 /	3.18
Vansul masterbatch	lb.	.95 /	1.95
Williams Ocher	lb.	.0575/	.06

Dusting Agents

Antidust	lb.	.405 /	.445
Diatomaceous silica	ton	32.00 /	48.00
Extrud-o-Lube, conc	gal.	1.33 /	1.69
Glycerized Liquid Lubricant, concentrated	gal.	1.25 /	1.63
Glyso-Lube, #3	lb.	.14	
Latex-Lube GR	lb.	.20	
Pigmented	lb.	.1825	
R-66	lb.	.165	
Liqui-Lube	lb.	.1625	
N. T.	lb.	.1675	
Liquizinc No. 305	lb.	.30 /	.35
Lubrex	lb.	.25 /	.30
Mica 160 Biotite	lb.	.065 /	.0725
Mesh	lb.	.08 /	.0875
325 Mesh	lb.	.0825/	.09
Concord	lb.	.08 /	.09
Mineralite	ton	45.00	
Pigmented Separex, LG	lb.	.105	
Slab-Dip, S-20	lb.	.11 /	.15
Pyrax A	ton	14.50 /	15.00
W. A.	ton	17.00 /	17.50
Rexanol	lb.	.13	
Talc, comml	ton	18.40 /	38.50
EM	ton	11.00 /	63.00
LS Silver	ton	29.25	
Nytals	ton	28.00 /	38.00
Sierra Sagger 7	ton	34.00	
White IR	ton	19.75	
III	ton	20.75	
Vanfre	gal.	1.95 /	3.00
Wet-Zinc, CW, P	lb.	.20 /	.2225

Extenders

BRS 700	lb.	.02 /	.036
BRT 7	lb.	.035 /	.036
Cumar Resins	lb.	.095 /	.19
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29 /	.36
Brown	lb.	.1425/	.263
Neophax	lb.	.157 /	.268
White	lb.	.144 /	.285
G. B. Asphaltenes	lb.	.097 /	.177
Millex, W	lb.	.07	
Mineral Rubbers			
Black Diamond	ton	38.00 /	40.00
Hard Hydrocarbon	ton	53.00 /	60.00
Hydrocarbon MR	ton	45.00 /	55.00
Parmr	ton	21.00 /	29.00
T-MR Granulated	ton	47.50 /	50.00
Nuba No. 1, 2	lb.	.0575/	.0625
3X	lb.	.0775/	.0825
OPD-101	lb.	.26	
Rubber substitute, brown	lb.	.16 /	.2572
Car-Bel-Ex A	lb.	.14	
Car-Bel-Lite	lb.	.35	
Extender 600	lb.	.1765	
White	lb.	.192 /	.2103
Stan-Shells	ton	35.00 /	73.00
Sublac Resin PX-5	lb.	.215 /	.235
Sundex 53	gal.	.12	
85	gal.	.1725	
Synthetic 100	lb.	.41	
Vistanex L grades	lb.	.35	

Fillers, Inert

Agrashell flour	ton	50.00 /	74.00
Albacar	ton	55.00 /	75.00
Barytes, floated, white	ton	49.00 /	70.85
No. 1	ton	55.00 /	77.50
2	ton	50.00 /	72.50
Off-color, domestic	ton	25.00	
Sparmite	ton	95.00 /	117.00
Blanc fixe	ton	100.00 /	165.00
Burgess HC-75	ton	12.00 /	30.00
80	ton	14.00 /	32.00
Iceberg	ton	50.00 /	80.00
Pigment #20	ton	35.00 /	60.00
#30	ton	37.00 /	60.00
WP #1	ton	11.00 /	16.00
Camel-Carb	ton	14.00	
-Tex	ton	22.00	
-Wite	ton	35.00	
Cary #200	ton	30.00 /	55.00
Citrus seed meal	lb.	.04	
Oil	lb.	.15	

Note

Suppliers are requested to submit product additions or deletions and price changes promptly as they occur in order that we may make the listing of maximum service to our readers. Comments on the present listing and classifications are invited with a view toward facilitating location of specific items.

Correspondence should be directed to Market Editor, RUBBER WORLD, 630 Third Avenue, New York 17, New York.

DC Silica	lb.	$1.15 /	$1.40
Diatomaceous silica	ton	32.00 /	48.00
Flocks			
Cotton, dark	lb.	.095 /	.135
Dyed	lb.	.55 /	.60
White	lb.	.13 /	.33
Fabrifil X-24-G	lb.	.135	
X-24-W	lb.	.235	
Filfloc 6000	lb.	.33	
F-40-900	lb.	.135	
HSC #35 Silicone Emulsion	lb.	1.22 /	2.46
Hydrite	ton	25.00 /	50.00
Kalite	ton	52.50 /	67.50
Lithopone, comml	lb.	.075 /	.085
Eagle	lb.	.0725/	.075
Permolith	lb.	.08 /	.0875
Sunolith	lb.	.075 /	.0825
Mica, 160 Biotite	lb.	.065 /	.0725
Mesh	lb.	.08 /	.0875
160 Mesh, 325 Mesh	lb.	.075 /	.09
Concord	lb.	.08 /	.09
Millical	ton	38.00 /	53.00
Mineralite	ton	40.00 /	60.00
Non-Fer-Al	ton	35.00 /	50.00
Ohio Superspray lime	ton	16.50	
Pulverized limestone, Stonelite	ton	8.25 /	11.00
Purecal	ton	56.75 /	71.75
Pyrax A	ton	14.50 /	15.00
W. A.	ton	17.00 /	17.50
Sawdust	ton	14.00 /	35.00
Silversheen Mica	lb.	.08 /	.09
Stan White	ton	10.50 /	13.10
Super-White Silica	ton	25.00 /	46.50
Surfex	ton	37.50 /	52.50
MM	ton	42.00 /	57.00
Suspenso	ton	38.00 /	53.00
Ti-Cal	lb.	.0675	
Valron Estersil	lb.	2.00 /	2.25
Walnut shell flours	ton	50.00 /	84.00
Whiting, limestone			
Atomite	ton	32.50 /	35.00
Calcite	ton	23.00	
Calwhite	ton	20.00 /	27.00
-T	ton	23.00	
Duramite	ton	20.00	
Gamaco	ton	32.50 /	40.00
Keystone	ton	20.00 /	22.00
Laminar	ton	30.00	
No. 10 White	ton	11.00 /	16.50
Omya	ton	30.00	
BSH	ton	45.00	
Paxinosa	ton	14.50 /	22.50
Snowflake	ton	17.00 /	18.00
Witco	ton	13.00	
York	ton	9.50	

Finishes

Apex Bright Finish #5200-E	lb.	.25	
Rubber Finish	gal.	2.50	
Black-out	gal.	4.50 /	8.00
Flocks, Rayon, colored	lb.	.90 /	1.50
White	lb.	.75 /	1.25
Also see Flocks, under Fillers, Inert			
Paraflint RG and RGU Synthetic Wax	lb.	.15 /	.22
Rubber lacquer, clear	gal.	1.00 /	2.00
Shellacs, Angelo	lb.	.485 /	.7325
Vac Dry	lb.	.485 /	.57
Talc (*See Talc, under Dusting Agents*)			
Unidip	lb.	.15 /	.20
Wax, Bees	lb.	.67 /	.83
Carnauba	lb.	.57 /	1.13
Monten	lb.	.27	
Neutral	gal.	.76 /	1.31
No. 118, colors	gal.	.86 /	1.41
Van Wax	gal.	2.00 /	2.05

Latex Compounding Ingredients

Acintol D, DLR	lb.	.0625/	.085
FA #1	lb.	.0675/	.09
#2	lb.	.0825/	.105
Accelerator 552	lb.	2.25	
Accelerator J-117, -302	lb.	1.00 /	1.15
-144	lb.	.15 /	.30
-307	lb.	1.10 /	1.25
-311	lb.	.60 /	.75
Aerosol, dry types	lb.	.65 /	.80
Liquid types	lb.	.40 /	.75
Alcogard 354	lb.	1.40 /	1.42
Alcogum AK-12	lb.	$0.12 /	$0.14
AN-6	lb.	.055 /	.06
-10	lb.	.09 /	.10
-25	lb.	.31	
PA-15	lb.	.16	
Alrosol	lb.	.41	
Amberex solutions	lb.	.1675/	.18
Antifoam J-114	lb.	3.25 /	3.45
P-242	lb.	.24 /	.35
Antioxidant J-137, -140	lb.	.55 /	.70
-139, -293	lb.	1.45 /	1.60
-182	lb.	2.00 /	2.15
-186	lb.	1.40 /	1.55
2246	lb.	1.50 /	1.53
Anti Webbing Agent J-183	lb.	.75 /	.90
-297	lb.	.27 /	.40
Aquablak B	lb.	.0975/	.1025
G	lb.	.12 /	.125
K	lb.	.12 /	.125
M	lb.	.105 /	.11
Aquarex D	lb.	.81	
G	lb.	.21	
L	lb.	.94	
MDL	lb.	.33	
ME	lb.	.82	
Aquarex NS	lb.	.60	
SMO	lb.	.50	
WAQ	lb.	.22	
Ben-A-Gels	lb.	.98	1.40
Bentone 18, 18C	lb.	.45	
34	lb.	.60	
Casein	lb.	.22	
Cellosize WP-09, -3, -40,			
-300	lb.	1.00 /	1.17
CW-12	lb.	.85	
-37	lb.	.70	
DC Antifoam A Compound	lb.	5.45 /	6.65
B	lb.	.63 /	1.10
Emulsion	lb.	2.05 /	4.00
AF Emulsion	lb.	2.05 /	2.85
Compound 7	lb.	5.13 /	6.50
Defoama W-1701	lb.	.125	
Defoamer 115a	lb.	.50	
NDW	lb.	.215 /	.235
Dispersing Agents			
Blancol	lb.	.1525/	.26
N	lb.	.155 /	.26
Darvan Nos. 1, 2, 3	lb.	.22 /	.30
Daxad 11, 21, 23, 27	lb.	.08 /	.30
Dispersaid H7A	lb.	.58	
1159	lb.	.43	
Emulphor ON-870	lb.	.50 /	.70
Igepal CO-630	lb.	.2875/	.47
Igepon T-73	lb.	.285 /	.495
T-77	lb.	.45 /	.69
Indulins	lb.	.06 /	.08
Kreelons	lb.	.132 /	.155
Laurelton Oil	lb.	.18	
Leonil SA	lb.	.52 /	.65
Lomar PW	lb.	.18	
Marasperse CB	lb.	.1225/	.1425
N	lb.	.095 /	.105
Modicols	lb.	.17 /	.58
Nekal BA-75	lb.	.395 /	.54
BX-76	lb.	.63 /	.75
Nopco 1287	lb.	.155 /	.195
Orzan A	lb.	.0325	
S	lb.	.0425	
Pluronics	lb.	.335 /	.40
Polyfons	lb.	.08 /	.09
Sorapon SF-78	lb.	.28 /	.40
Tergitol 7	lb.	.4125/	.44
NPX	lb.	.275 /	.3074
TMN	lb.	.2875/	.32
Trenmine W-30	lb.	.15	
W-40	lb.	.60 /	.75
Triton R-100	lb.	.12 /	.25
X-100, -102, -114	lb.	.255 /	.36
Dispersions			
Agebest 1293-22	lb.	1.90 /	2.00
AgeRite Alba	lb.	3.00	
Powder, Resin D	lb.	.80	
White	lb.	1.80	
Altax	lb.	.75	
Shield No. 2, 6	lb.	.08	
3	lb.	.095	
4-35	lb.	.09	
5	lb.	.093	
7-F, 8	lb.	.165	
55	lb.	.18	
Iron Oxide, 60%	lb.	.40	
L.S.W.	lb.	1.50	
No. 305 Liquizinc	lb.	.30 /	$0.35
P-33	lb.	.35	
Rotax	lb.	.75	
Sulfur	lb.	.13 /	.15
Telloy	lb.	3 62	
Tuads, Methyl	lb.	1.60	
Vulcacure NB	lb.	.45	
NS	lb.	.75 /	1.05
T.M.D.	lb.	1.14	
ZB, ZE, ZM	lb.	.85 /	.89
Vulcanizing, C group	lb.	.40 /	1.30
G group	lb.	.45 /	.90
N group	lb.	.40 /	1.00
Zetax	lb.	.75	
Zimates, Butyl	lb.	1.30	
Ethyl, Methyl	lb.	1.35	
Zinc oxide	lb.	.40	
Emulsions			
AgeRite Spar	lb.	1.00	
Stalite	lb.	.75	
Superlite	lb.	1.00	
Borden Arcco A-25, A-26,			
716-30	lb.	.18 /	.19
555-40R	lb.	.185 /	.205
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175

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Graduate chemical engineer. Product development work plastics and elastomers—similar experience desirable, but not necessary. Send résumé and salary desired. E. L. Bixby, GOODALL RUBBER CO., Trenton 4, N. J.

RUBBER CHEMIST

Experienced rubber chemist for compounding and formulating rubber soling wanted. Send complete details together with salary requirements to:

PERSONNEL DEPARTMENT
BATA SHOE COMPANY, INC.
BELCAMP, MARYLAND

RUBBER CHEMIST

The Sprague Electric Company in rural New England desires the services of a qualified rubber chemist to head up a new Rubber Development Section in the Research and Engineering Laboratories. Previous experience in compounding Viton, Fluorel and Kel-F elastomers in addition to the standard synthetics for fabricating gaskets, O-rings and bushings desirable. The man we are looking for will be responsible for evaluating new elastomers, compounding rubbers to meet specific applications, the fabrication of sample quantities of finished items and working with suppliers of production rubber parts.

Send résumé to:

John Schimmel III, Manager
Scientific Staff Relations
Sprague Electric Company
North Adams, Massachusetts

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ESTABLISHED MANUFACTURERS' REPRESENTATIVES

One each for Indiana, Southern Illinois, and Wisconsin to represent molder of custom rubber parts. Located in Chicago, 13 years young, aggressive. Specialize in intricate, accurate parts, natural and synthetic, colored and black. Exclusive territory—good commissions. Address Box No. 2476, care of RUBBER WORLD.

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Challenging opening. B.S. in Chemistry or Chemical Engineering. 4 years' experience in passenger and truck tire compounding. Must have an interest in research and development. Salary open. Other benefits. Replies confidential. Send résumé to Box No. 2478, care of RUBBER WORLD.

SOLVENT ADHESIVE CHEMIST

Capable of assuming responsibility for broad range of rubber base solvent cements and adhesives. Duties include research and development and technical service. Experience desirable. Write to Personnel Department, UBS Chemical Company, Division of A. E. Staley Manufacturing Co., 491 Main St., Cambridge, Mass.

RUBBER COMPOUNDERS FOR RAPIDLY EXPANDING DEVELopment Department to match company growth. 3-5 years' experience with emphasis on processing desired. Bachelor Degree or equivalent required. Replies confidential. Rubbermaid, Inc., Wooster, Ohio.

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RUBBER AND PLASTIC COMPOUNDER, MANAGEMENT, CHEMical Engineer. Experienced in military and commercial specifications. Know wire and cables. Address Box No. 2475, care of RUBBER WORLD.

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RUBBER DEVELOPMENT CHEMIST: 17 YEARS' CUSTOM molding experience in development of compounds, manufacturing procedures, and customer requirements. Responsible challenging position desired. Address Box No. 2479, care of RUBBER WORLD.

RUBBER TECHNOLOGIST, OVER FIFTEEN YEARS' DIVERSIfied background in mechanical rubber goods, seeks responsible position in development or production. Experience includes compounding, manufacturing, management, development, cost estimation, raw materials, etc. Address Box No. 2482, care of RUBBER WORLD.

TECHNICAL SERVICE AND/OR SALES POSITION DESIRED. Experience includes compounding, development, production, technical service and sales background. Address Box No. 2483, care of RUBBER WORLD.

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—FOR SALE—

4—Blaw Knox 6' x 40' Horizontal Vulcanizers with quick-opening doors, 250# working pressure, ASME.
2—Royle #½ Extruders, complete.
1—Peerless Guillotine Cutter, 30" blade, with motor.
1—Allen 4" Extruder with 25 HP motor.
Address Box No. 2473, care of RUBBER WORLD.

FOR SALE: BAKER-PERKINS #15-UUMM DISPERSION BLADE double-arm mixer, 100-gallon, jacketed, 100-HP explosion-proof motor, motorized tilt, cored blades, compression ram cover. Also 200-gallon B-P mixers. PERRY EQUIPMENT CORP., 1424 N. 6th St., Phila. 22, Pa.

FOR SALE: 1—FARREL-BIRMINGHAM SIZE "B" BANBURY Mixer; 1—Farrel-Birmingham 8" x 16" 2-Roll Mill chromeplated; 1—Baker-Perkins 9-gal. 304 S.S. sigma-blade Mixer; 1—Baker-Perkins 100-gal. Sigma-blade Mixer; 1—Baker-Perkins size #16TRM 150-gal. sigma-blade vacuum Mixer; 1—Baker-Perkins 100-gal. masticating blade Mixer 100 HP; 1—Ball & Jewel #1 Rotary Cutter; Powder Mixers; Tablet Presses; Screens. Your inquiries solicited. BRILL EQUIPMENT COMPANY, 35-49 Jabez Street, Newark, N. J.

Habuco Resin Nos. 502, 515, 523	lb.	$0.195	$0.20
503	lb.	.22	.225
504, 526	lb.	.19	.195
517	lb.	.175	.18
524	lb.	.155	.16
Resin A-2	lb.	.16	.25
P-370	lb.	.175	.25
X-210	lb.	.12	.22
Freeze-Stabilizer 322	lb.	.40	
12116C	lb.	.52	
Hyonic PE 250	lb.	.255	.295
Igepon T-43	lb.	.145	.35
T-51	lb.	.125	.285
-73	lb.	.285	.495
Ludox	lb.	.1675/	.195
Marmix	lb.	.41	.48
Merac	lb.	.75	1.05
Micronex, colloidal	lb.	.06	.072
Modical S	lb.	.3084/	.3284
VD	lb.	.1384/	.1584
Monsanto Blue 4685 WD	lb.	1.60	
Green 4884 WD	lb.	1.80	
Red 127	lb.	1.25	
OPD 101	lb.	.16	.26
Picco Latex Plasticizer A-12	lb.	.069	.096
Pliolite Latex 150, 190	lb.	.32	.41
170	lb.	.37	.46
Polyvinyl methyl ether	lb.	.25	.45
Resin V	lb.	.13	
Roelgel 100C	lb.	.46	
Santomerse #3 Paste	lb.	.26	.30
Sellogen Gel	lb.	.1275	
Sequestrene AA	lb.	.905	.975
ST	lb.	.585	.615
30A	lb.	.245	.265
Setsit #5	lb.	.75	1.05
#9	lb.	.85	1.15
Stablex A	lb.	.80	1.10
B, G	lb.	.50	.95
K	lb.	.27	.35
P	lb.	.35	.50
T	lb.	.14	.22
Surfactol 13	lb.	.345	.36
Vult-Accel E	lb.	.85	.92
Webnix	lb.	1.50	2.50

Mold Lubricants

A-C Polyethylene	lb.	.30	.47
Acintol D	lb.	.0625/	.085
Alipal CO-433	lb.	.25	.45
CO-436	lb.	.22	.41
Aquarex Compounds	lb.	.21	.94
Carbowax 200, 300, 400	lb.	.22	.25
1500	lb.	.225	.2825
4000	lb.	.31	.32
6000	lb.	.35	.36
Castorwax	lb.	.3375/	.3575
Colite Concentrate	gal.	.90	1.15
D-Tak Dip #10	gal.	1.50	
DC Mold Release Fluid	lb.	3.14	4.75
200 Fluid	lb.	3.14	4.75
Compound 4, 7	lb.	5.13	6.50
Emulsion 7	lb.	1.20	1.74
8, 35, 35A, 35B, 36	lb.	1.20	1.74
ELA	lb.	.82	
FT Wax 200	lb.	.265	.42
300	lb.	.295	.45
Glycerized Liquid Lubricant, concentrated	gal.	1.25	1.63
Igepals	lb.	.2875/	.74
Igepon AP-78	lb.	.44	.68
T-43	lb.	.145	.35
-51	lb.	.125	.285
-73	lb.	.285	.495
L-45 Silicone Oil	lb.	2.90	4.61
LE-45 Silicone Oil Emulsion	lb.	1.15	1.69
LE-450 Silicone Emulsion	lb.	1.15	1.69
L-520 Organo-Silicone Fluid	lb.	2.46	3.50
L-522 Organo-Silicone Fluid	lb.	2.68	3.50
Lubrex	lb.	.27	.32
Lubri-Flo	gal.	10.00	12.05
Lustermold	lb.	.41	
Mold Lubricant No. 426	lb.	.18	
Paste	lb.	.25	
Monopole Oil	lb.	.16	
Monten Wax	lb.	.57	
MR-22	gal.	9.95	14.95
Para Lube	lb.	0.46	.048
Paraflint RG and RGU Synthetic Wax	lb.	.15	.22
Plaskon 8406, 8407	lb.	.30	.37
8416, 8417	lb.	.35	.42
8429	lb.	.40	.47
Pluronics	lb.	.335	.44
Poly-Brite PE-20	lb.	.28	.42
600	lb.	.42	.58
Poly-Cone 125X	lb.	1.20	1.40
1000	lb.	.93	1.06
Polyglycol E series	lb.	.29	.42
RA-1, -2, -3	gal.	2.25	3.00
Rubber Glo	gal.	.94	.97
Silrex S-1	lb.	.65	
SM-33, -55, -61, -62	lb.	1.22	1.76
Soap, Hawkeye	lb.	1.25	1.45
Purity	lb.	.155	.165
Sodium stearate	lb.	.40	
Stoner's 700 series	gal.	1.20	1.25
800 series	gal.	1.26	1.70
900 series	gal.	1.55	2.55
A series	gal.	1.80	4.50
Ucon 50-HB Series	lb.	.25	.375
Ulco	lb.	.12	.23
Vanfre	gal.	1.95	3.00
XLE-420 Silicone Oil Emulsion	lb.	1.18	1.70

Odorants

Alamasks	lb.	$0.75	$6.50
Coumarin	lb.	2.95	3.55
Ethavan	lb.	6.75	7.35
Latex Perfume #7	lb.	4.00	
Neutroleum Gamma	lb.	3.60	
Rodo	lb.	4.00	5.50
Rubber Perfume #10	lb.	2.60	
Vanillin, Monsanto	lb.	3.00	3.15

Plasticizers and Softeners

Acintol DLR	lb.	.0625/	.085
Adipol 2EH, 10A, XX	lb.	.40	.425
BCA	lb.	.45	.475
ODY	lb.	.40	.425
Admex 710	lb.	.3325/	.3625
711	lb.	.3325/	.3825
744	lb.	.3925/	.3825
Aro Lene #1980	lb.	.10	.12
Baker AA Oil	lb.	.195	.24
Crystal O Oil	lb.	.21	.255
Processed oils	lb.	.215	.235
Bardol, 639	lb.	.0275/	.0375
B	lb.	.055	.065
Benzoflex 2-45	lb.	.26	.29
9-88	lb.	.27	.30
Bondogen	lb.	.555	.605
BRC-20	lb.	.022	.0245
22	lb.	.026	.0285
30	lb.	.0165/	.025
521	lb.	.023	
BRH 2	lb.	.0341/	.0351
BRS 700	lb.	.036	
BRT 7	lb.	.035	.036
BRV	lb.	.0625/	.065
Bunarex Liquid	lb.	.0425/	.0555
Resins	lb.	.085	.095
Bunatak AH	lb.	.085	.095
N	lb.	.31	
U	lb.	.175	
83	lb.	.0685	
90	lb.	.09	
210	lb.	.14	
Bunnatol G, S	lb.	.40	.505
Butac	lb.	.1735/	.1835
Butyl stearate, comml.	lb.	.255	
B-17	lb.	.22	.26
Binney & Smith	lb.	.23	.26
Harchem	lb.	.2525/	.3425
Kessoflex	lb.	.245	.275
Ohio-Apex	lb.	.26	.27
Butyl stearate—G.P.	lb.	.0125/	.02
R-100	lb.	.045	.0525
TT	lb.	.017	.02
Califlux 510, 550	lb.	.0275/	.0375
G.P.	lb.	.015	.0225
R-100	lb.	.0475/	.0575
T-T	lb.	.019	.0295
Capryl alcohol, comml.	lb.	.195	.30
Columbian Carbon	lb.	.195	.30
Harchem	lb.	.195	.30
Chlorowax 40	lb.	.1625/	.1825
70	lb.	.185	.245
-S	lb.	.21	.27
Circo light	gal.	.17	
Circosol-2XH	gal.	.185	
Contogums	lb.	.0875/	.111
Cumar Resins	lb.	.065	.17
DBM (dibutyl-m-cresol) Darax	lb.	.32	.3475
DBP (dibutyl phthalate), comml.	lb.	.26	.40
Darex	lb.	.30	.33
Eastman	lb.	.26	.30
Harflex 140	lb.	.275	.315
Harwick Std. Chem. Co.	lb.	.325	.385
Hatco	lb.	.30	.33
Monsanto	lb.	.285	.325
Naugatuck	lb.	.30	.33
PX-104	lb.	.26	.30
Rubber Corp. of America	lb.	.275	.43
Sherwin-Williams	lb.	.30	.33
DBS (dibutylsebacate) comml.	lb.	.66	.69
Eastman	lb.	.655	.685
Harflex 40	lb.	.655	.685
Hatco	lb.	.66	.685
Monoplex	lb.	.66	.675
Naugatuck	lb.	.665	.69
PX-404	lb.	.665	.685
DCP (dicapryl phthalate), comml.	lb.	.295	.325
Harflex 180	lb.	.26	.30
Hatco	lb.	.295	.325
Monoplex	lb.	.30	.315
DDA (didecyladipate) Good-rite GP-236	lb.	.40	.59
Kessoflex	lb.	.40	.435
DDP (didecylphthalate) Good-rite GP-266	lb.	.295	.45
Hatco	lb.	.305	.435
Defoamer X-3	lb.	.355	
DIBA (diisobutyladipate) Darex	lb.	.4325/	.4625
Eastman	lb.	.40	.44
Ohio-Apex	lb.	.41	.435
DIDA (diisodecyladipate) Monsanto	lb.	.40	.44
RC	lb.	.40	.44
DIDP (diisodecylphthalate) Darex	lb.	.32	.35
Harflex 110	lb.	.265	.305
Monsanto	lb.	.26	.30
Ohio-Apex	lb.	.26	.30
PX-120	lb.	.26	.30
RC	lb.	.265	.305
Dielex B	lb.	$0.06	
Diethylene glycol, comml.	lb.	.1525/	$0.1825
Wyandotte	lb.	.15	.165
Di-2 ethylhexyl azelate	lb.	.455	.495
Dinopol IDO	lb.	.285	.32
DIOA (diisooctyladipate) Kessoflex	lb.	.40	.435
Naugatuck	lb.	.435	.465
PX-208	lb.	.40	.435
Rubber Corp. of America	lb.	.40	.44
DIOP (diisooctylphthalate), comml.	lb.	.305	.335
Darex	lb.	.32	.35
Eastman	lb.	.25	.29
Harflex 120	lb.	.26	.30
Hatco	lb.	.305	.335
Monsanto	lb.	.26	.30
Naugatuck	lb.	.305	.335
Ohio-Apex	lb.	.25	.29
PX-108	lb.	.26	.30
Rubber Corp. of America	lb.	.26	.30
Sherwin-Williams	lb.	.32	.34
DIOS (diisooctylsebacate), comml.	lb.	.61	.64
Rubber Corp. of America	lb.	.5925/	.6325
DIOZ (diisooctylazelate) Cabflex	lb.	.48	.51
Dipolymer Oil	gal.	.33	.48
Dispersing Oil No. 10	lb.	.06	.0625
DNODA (di-n-octyl-n-decyl adipate), Monsanto	lb.	.40	.44
DOA (dioctyladipate), comml.	lb.	.425	.455
Eastman	lb.	.40	.44
Good-rite GP-233	lb.	.40	.55
Harflex 250	lb.	.40	.435
Hatco	lb.	.435	.465
Monsanto	lb.	.40	.44
Naugatuck	lb.	.435	.465
PX-238	lb.	.40	.435
Rubber Corp. of America	lb.	.40	.44
DOP (dioctylphthalate), comml.	lb.	.305	.335
Darex	lb.	.32	.35
Eastman	lb.	.26	.30
Good-rite GP-261	lb.	.285	.44
Harflex 150	lb.	.26	.30
Hatco	lb.	.305	.335
Monsanto	lb.	.26	.30
Naugatuck	lb.	.305	.335
Ohio-Apex	lb.	.25	.29
Polycizer 162	lb.	.28	.435
PX-138	lb.	.25	.29
Rubber Corp. of America	lb.	.25	.30
Sherwin-Williams	lb.	.305	.335
DOS (dioctylsebacate) comml.	lb.	.61	.64
Eastman	lb.	.61	.64
Harflex 50	lb.	.5925/	.6225
Hatco	lb.	.61	.635
Monoplex	lb.	.61	.635
Naugatuck	lb.	.615	.64
PX-438	lb.	.5925/	.6225
Rubber Corp. of America	lb.	.5925/	.6325
Drapex 3.2	lb.	.40	.54
Dutch Boy NL-A10 (DBP)	lb.	.30	.33
-A20 (DOP), A30 (DIOP)	lb.	.305	.335
-A54	lb.	.295	.325
-C20 (DOS)	lb.	.61	.63
-F21	lb.	.395	.425
-F31	lb.	.44	.47
-F41	lb.	.48	.51
Dutrex 6	lb.	.025	.035
Dymerex Resin	lb.	.135	.1475
Elastex 36-R	lb.	.43	.4625
37-R	lb.	.70	.71
Emulphor EL-719	lb.	.52	.73
Endor	lb.	.67	
Ethox	lb.	.43	.455
Ethylene glycol, comml.	lb.	.135	.165
Wyandotte	lb.	.1325/	.1425
Flexol 3 GH	lb.	.44	.46
3 GO	lb.	.53	.55
4 GO	lb.	.325	.355
10-A	lb.	.425	.455
426	lb.	.27	.30
810, 810X, 10-10, 10-10X	lb.	.305	.335
TPF, A-26	lb.	.435	.465
Flexricin P-4	lb.	.3475/	.3625
P-6	lb.	.415	.43
Flexricin P-8	lb.	.3475/	.3625
PG-16	lb.	.335	.35
Fortex	lb.	.125	.145
Fura-Tone NC 1008	lb.	.28	
1012	lb.	.46	
G. B. Asphaltic Flux	gal.	.097	.177
Naphthenic Neutrals	gal.	.125	.215
Process oil, light	lb.	.0275/	.0375
Medium	lb.	.0375/	.0475
Galex W-100	lb.	.155	.18
W-100 D	lb.	.1525/	.1775
Gilsowax B	lb.	.0975/	.11
Harchemex	lb.	.24	.285
Harflex 300	lb.	.58	.615
325	lb.	.4325/	.46
375	lb.	.7425/	.83
500	lb.	.315	.41
HB-20	lb.	.15	.185
-40	lb.	.19	.23
Heavy Resin Oil	lb.	.0225/	.0375
HSC-13	lb.	.25	.32
-39	lb.	.22	.29
Hycar 1312	lb.	.60	
Hypalon Peptizer H-20	lb.	1.59	1.79
Kapsol	lb.	.33	.35
Kenflex A, L	lb.	.26	.27
B	lb.	.23	.24
N	lb.	18	.19

MACHINERY & SUPPLIES FOR SALE (CONTINUED)

THIS MONTH'S SPECIALS

Rubber Mills, 30", 42", 50", and 60" sizes in stock. 600-Ton Adamson Slab Side 8-Opening Hydraulic Press, 42" x 42" Platen, 26" chrome-plated ram. Worthington Hydraulic Pump, duplex double-acting 200 GPM, 2500 PSI. Ideal for accumulator system. Vaughn 18" x 40" 4-Roll "L" Type Calender with motor and reduction drive. Allen 6" Rubber Tuber with strainer head. 24" x 24" Molding Presses with 12", 14", and 16" rams. A full line of equipment for the Rubber Industry: Banbury Mixers, Tubers, Rubber Mills, Molding Presses, Die Cutting Presses, Accumulators, Vulcanizers, etc., etc. Write for brochure on our new 6" x 13" Rubber Lab Mill. WE WILL FINANCE. JOHNSON MACHINERY COMPANY, 90 Elizabeth Avenue, Elizabeth, New Jersey. ELizabeth 5-2300.

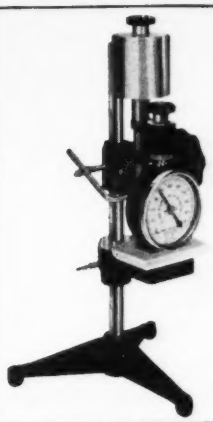
FARREL 16" x 40" TWO-ROLL MILL, OTHER SIZES UP TO 60" Hydraulic Presses, 300-ton upstroke 40" x 30". 300-ton upstroke 22" x 35". 240-ton upstroke with ten 24" x 56" platens. 200-ton Farrel 30" x 30". 150-ton Farrel 24" x 24" and other sizes. MPM 3½" wire covering Extruder. Adamson 6" Rubber Extruder. New and used Laboratory 6" x 13", 6" x 16", and 8" x 16" Mills and Calenders. Baker-Perkins and Day heavy-duty Jacketed Mixers up to 200 gallons. Hydraulic pumps and Accumulators. Rotary Cutters. Peerless 2-HP Rubber Bale Cutter. Banbury Mixers, Crushers, Churns, Tubers, Vulcanizers, Bale Cutters, Gas Boilers, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT COMPANY, 107—8th STREET, BROOKLYN 15, NEW YORK. STERLING 8-1944.

HANNIFIN HY-POWER HYDRAULIC UNITS, MODEL J.B.: 5—100-ton, w/170-gal. Reservoir; 4—150-ton, w/255-gal. Res.; 1—200-ton, w/340-gal. Res. Vertically mounted 3-ph. Motors, 1000 to 5000 P.S.I. w/intensifiers. Late Models. Further information on request. DALTON SUPPLY CO., 2829 Cedar St., Phila 34, Pa.

FOR SALE: 1—10" x 24" THROPP 3-ROLL VERTICAL CALENDER: 1— 24" x 24" Bolling hydraulic press, 16" ram; 2—125-gallon Day gearless pony mixers, 10 HP; 1—6" x 16" Thropp 2-roll mill. CHEMICAL & PROCESS MACHINERY CORP., 52 9th Street, Brooklyn 15, N. Y., HY 9-7200.

QUALITY EQUIPMENT AT REASONABLE PRICES

MILLS: F-B. Unused 2-Roll 14" x 30" Late Type with Uni-Drives. Also, 16" x 36", 18" x 42", 22" x 60". CALENDERS: 2-Roll 12" x 24", 22" x 58". EXTRUDERS: NRM 1½" with vari-drive. NRM 6" Rubber Tuber with 75-HP Motor, Hydr. Vertical 15" Extruding Strainer: VULCANIZERS: 6' x 16' and 18' ASME. PRESSES: Stokes Model 280; 4" Dia. Pre-Form; Colton Model 5½" Pre-Form Press; 3 French Oil Presses, 10" Ram; Dunning & Boschert Presses; 12" Ram; Stewart-Bolling 22" Ram; 36" x 36"; 6 Southwark Presses; 14" Rams; 36" x 36"; HPM 300-Ton Compression Molding Press 4 Post, complete; HPM Size 1200 H 60 A Injection Molding Press; 60 oz; 100-HP Motor. MIXERS: Baker-Perkins Heavy-Duty Double-Arm Mixers up to 300 Gal.; Banbury No. 9; Day 40-Gal. Pony Mixers; NEW FALCON Ribbon Mixers; all sizes. SPECIAL: F-B Belt Press 52" x 31'; two openings. IMPREGNATORS: Stokes Dbl.-Chamber 5648 Utility Rubber Stock Cutter; conveyors. FIRST MACHINERY CORP., 209-289 Tenth St., Bklyn. 15, N. Y. ST 8-4672.



RUBBER HARDNESS
ORIGINAL SHORE
DUROMETER
ASTM D676 AND ASTM D1484

Various models for testing the entire range of hardness from elastomeric to rigid. Available in quadrant or round dial case. May be used free hand or on table top OPERATING STAND WITH DEAD WEIGHT (left).

THE SHORE INSTRUMENT & MFG. CO., INC.
90-35 VAN WYCK EXP., JAMAICA 35, N.Y.

MACHINERY — ALBERT
REBUILT
ANYTHING AND EVERYTHING
P. E. ALBERT & SON
21 NOTTINGHAM WAY TEL. EX. 4-7181
TRENTON, N. J.

The Classified Ad Columns of RUBBER WORLD bring prompt results at low cost.

GUARANTEED REBUILT MACHINERY
IMMEDIATE DELIVERIES FROM STOCK

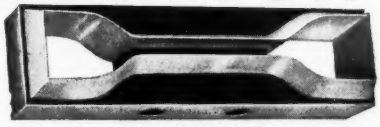
MILLS, CALENDERS, TUBERS
VULCANIZERS, ACCUMULATORS

UNITED

HYD. PRESSES, PUMPS, MIXERS
CUTTING MACHINES, PULVERIZERS

UNITED RUBBER MACHINERY EXCHANGE
183-189 ORATON ST. CABLE "URME" NEWARK 4, N. J.

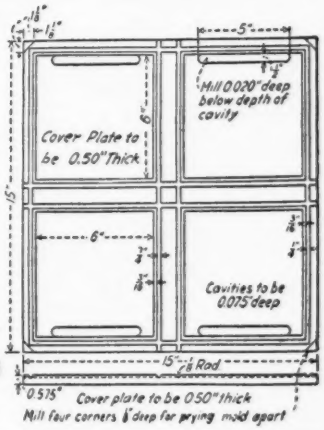
HOGGSON



DUMBBELL" Test Strip Die D412(51T)

TOOLS, MOLDS, DIES
For Rubber Testing and Production

For making tensile test samples, we make many types of slab molds. One is detailed at the right. These are plain or chrome finished. We usually stock molds for making adhesion, abrasion, flexing, compression and rebound test samples, but supply special molds promptly. We also furnish hand-forged tensile dies for cutting regular or tear test samples.


Mill 0.020" deep below depth of cavity
Cover Plate to be 0.50" Thick
Cavities to be 0.075" deep
SLAB→ MOLD D15-55
0.515" Cover plate to be 0.50" thick
Mill four corners ⅛" deep for prying mold apart

HOGGSON & PETTIS MFG. CO., 141S Brewery St., New Haven 7, Conn.
Pac. Coast: H. M. Royal, Inc., Downey, Calif.

Kessonex 103	lb.	$0.405	
105	lb.	.3325	
106	lb.	.38	
107	lb.	.525	
110	lb.	.24	
111	lb.	.28	
KP-23	lb.	.325 /	$0.335
-90	lb.	.40 /	.435
-140	lb.	.46 /	.485
-201	lb.	.45 /	.465
-260	lb.	.34 /	.375
Kronisol	lb.	.35 /	.385
Kronitex AA, I, K-3, MX	lb.	.325 /	.36
LX-685, -125, -135	lb.	.125 /	.135
Marvinol plasticizers	lb.	.28 /	.8825
Methox	lb.	.385 /	.41
Millrex	lb.	.35	
Monoplex S-38	lb.	.215 /	.24
S-71	lb.	.45 /	.475
Morflex	lb.	.25 /	.65
Natac	lb.	.1685/	.1785
Neoprene Peptizer P-12	lb.	1.12	1.32
W-9	lb.	2.28	2.48
Nevillac	lb.	.31 /	.85
Neville R Resins	lb.	.145 /	.205
Nevinol	lb.	.24	
No. 1-D heavy oil	lb.	.065	
NP-10	lb.	.44 /	.48
ODA (octyldecyladipate)			
Good-rite GP-235	lb.	.40 /	.55
Kessoflex	lb.	.40 /	.435
RC	lb.	.40 /	.44
ODP (octyldecylphthalate)			
Good-rite GP-265	lb.	.29 /	.445
Hatco	lb.	.305 /	.335
Rubber Corp. of America	lb.	.265 /	.305
Ohopex Q-10	lb.	.265 /	.305
R-9	lb.	.3525/	.3775
Orthonitro benzophenol, comml.	lb.	.13 /	.15
Palmalene	lb.	.15	
Panaflex BN-1	lb.	.185 /	.225
Panarez Resins	lb.	.09 /	.14
Para Flux, regular	gal.	.10 /	.2125
No. 2016	gal.	.165 /	.24
2332	gal.	.11	
4205	lb.	.1075/	.2125
Para Lube	lb.	.46 /	.48
Resins	lb.	.04 /	.045
Paradene Resins	lb.	.07 /	.08
Paraplex 5-B	lb.	.29 /	.3475
Al-111	lb.	.32 /	.3275
G-25	lb.	.76 /	.77
-40	lb.	.4825/	.51
-50	lb.	.39 /	.4175
-53	lb.	.4325/	.46
-60	lb.	.325 /	.35
-62	lb.	.345 /	.37
RG-7	lb.	.33 /	.335
-8	lb.	.505 /	.5125
-10	lb.	.52 /	.5275
Pepton 22	lb.	.83 /	.86
65	lb.	1.23 /	1.26
65-B	lb.	.83 /	.86
Philrich 5	gal.	.125	
Picco Resins	lb.	.09 /	.17
480 Oilproof Series	lb.	.18 /	.23
Aromatic Plasticizers	lb.	.07 /	.09
Liquid Resin D-165 (Y)	lb.	.06 /	.075
(Z-3)	lb.	.07 /	.085
(Z-6)	lb.	.08 /	.095
S. O. S.	gal.	.29 /	.34
Piccocizers	lb.	.05 /	.07
Piccolastic Resins	lb.	.21 /	.27
Piccolyte Resins	lb.	.205 /	.245
Piccopale Resins	lb.	.12 /	.135
Piccovars	lb.	.165 /	.20
Piccovol	lb.	.025 /	.038
Pictar	gal.	.25 /	.48
Pigmentar	lb.	.046 /	.0634
Pigmentaroil	lb.	.046 /	.0634
Pitch, Burgundy, Sunny South	lb.	.103 /	.1085
Pitt-Consol 500	lb.	.28 /	.305
640	lb.	.42	
Plasticizers			
42	lb.	.34 /	.40
84	lb.	.25 /	.29
B	lb.	.35 /	.45
DP-520	lb.	.435 /	.455
MP	lb.	.035 /	.0755
MT-511	lb.	.6925/	.7425
ODN	lb.	.35 /	.475
SC	lb.	.38 /	.55
Plastoflex #3	lb.	.52 /	.57
#520	lb.	.36 /	.435
DBE	lb.	.50 /	.55
MGB	lb.	.29 /	.37
SP-2	lb.	.43 /	.48
VS	lb.	.3575/	.3975
Plastogen	lb.	.0875/	.09
Plastone	lb.	.25 /	.32
Polycin 470	lb.	.325 /	.34
Polycizers	lb.	.25 /	.415
;62	lb.	.25 /	.405
Polymel-C	lb.	.1775/	.1875
C-130, DX	lb.	.1375/	.1475
D	lb.	.225 /	.235
D-TAC	lb.	.1975/	.215
Poly-Sperse AP-2	lb.	.23 /	.295
AP-300	lb.	.26 /	.325
LC-20	lb.	.26 /	.325
R-100	lb.	.17 /	.235
PT Pine Tars	lb.	.038 /	.0554
101 Pine Tar Oil	lb.	.038 /	.0554
Reogen	lb.	.1425/	.145
Resin C pitch	lb.	.0225/	.031
R6-3†	lb.	.38 /	.40
Resinex 10, 25, 50, 110	lb.	.04 /	.045
70	lb.	.0325/	.0375
Resinex 85, 100	lb.	$0.035 /	$0.04
115	lb.	.0375/	.0425
L-2, L-3, L-4, L-5	lb.	.0225/	.03
Rosin Oil, Sunny South	gal.	.58 /	.76
RPA No. 2	lb.	.85	
3	lb.	.51	
Conc.	lb.	.85	
6	lb.	1.66	
RSN Flux	gal.	.10 /	.91
Rubber Oil B-5	lb.	.0225/	.0355
Rubberol	lb.	.18 /	.2725
Santicizer 1-H	lb.	.50 /	.57
8	lb.	.43 /	.47
9	lb.	.42 /	.44
140	lb.	.325 /	.36
141	lb.	.34 /	.375
160	lb.	.26 /	.30
409	lb.	.39 /	.42
603	lb.	.255 /	.295
B-16	lb.	.46 /	.49
E-15	lb.	.5225/	.5525
Santocizer	lb.	.4275/	.4575
Sebacic acid, purified, comml.	lb.	.59 /	.65
Binney & Smith	lb.	.64 /	.76
C. P.-Binney & Smith	lb.	.72 /	.84
Harchem	lb.	.655 /	.815
Sherolatum Petroleum	lb.	.05 /	.10
Softener #20	gal.	.10 /	.20
Special Rubber Resin 100	lb.	.1675/	.2175
Staflex AX	lb.	.43	
DBES	lb.	.61 /	.635
Syn-Tac	gal.	.33 /	.635
Synthol	lb.	.17 /	.2625
Tetraflex R-122	lb.	.245 /	.285
Thiokol TP-90B	lb.	.50	
-95	lb.	.65	
Triacetin	lb.	.37 /	.41
Tributyl phosphate	lb.	.50 /	.535
Tributyrin	lb.	.69	
Tricresyl phosphate, comml.	lb.	.33 /	.36
Monsanto	lb.	.325 /	.36
Naugatuck	lb.	.33 /	.36
PX-917	lb.	.33 /	.36
Triphenyl phosphate, comml.	lb.	.39 /	.40
Monsanto	lb.	.415 /	.435
Turgum S	lb.	.156 /	.166
SB	lb.	.105 /	.115
Turpol NC 1200	lb.	.61 /	.70
Tysonite	lb.	.3025/	.305
United	gal.	.69 /	1.20
X-1 Resinous Oil	lb.	.0225/	.0325

Reclaiming Oils

Bardol, 639	lb.	.0275/	.0375
B	lb.	.055 /	.065
BRH 2	lb.	.0213/	.0351
BRT 3	lb.	.02 /	.031
4	lb.	.02 /	.031
7	lb.	.035 /	.036
BRV	lb.	.0625/	.065
Burco-RA	lb.	.053 /	.0805
BWH-1	lb.	.16 /	.17
Dipolymer Oil	gal.	.33 /	.48
Dispersing Oil No. 10	lb.	.06 /	.0625
G. B. Oils	gal.	.115 /	.275
Heavy Resin Oil	lb.	.0225/	.0375
LX-572	gal.	.27 /	.32
-759	gal.	.1375	
-777, -809, -859	gal.	.23 /	.33
-869	gal.	.33 /	.43
-871	gal.	.34 /	.44
No. 3186	gal.	.28 /	.295
Picco 6535	gal.	.25 /	.30
C-33	gal.	.215 /	.385
-42	gal.	.23 /	.44
D-4	gal.	.27 /	.37
E-5	gal.	.25 /	.35
Q-Oil	gal.	.286 /	.36
Pitt-Consol 500	lb.	.28 /	.305
640	lb.	.42	
PT 101 Pine Tar Oil	lb.	.038 /	.0554
Reclaiming Oil #3186	gal.	.28 /	.385
-G	gal.	.25 /	.365
4039-M	gal.	.3275/	.3975
-Y	gal.	.30 /	.37
RR-10	lb.	.37	
S. R. O.	lb.	.015 /	.0225
X-1 Resinous Oil	lb.	.0225/	.0325

Reinforcers, Other Than Carbon Black

Angelo Shellacs	lb.	.485 /	.7325
Borden, Chem. Div.			
Arcco 978-42B	lb.	.18 /	.19
1073-18B	lb.	.135 /	.145
1294-36B	lb.	.115 /	.125
1301-12B	lb.	.15 /	.16
BRC-20	lb.	.0235/	.0245
22	lb.	.026 /	.0285
30	lb.	.0165/	.025
521	lb.	.023	
Bunarex Resins	lb.	.085 /	.095
Cab-o-sil	lb.	.66 /	1.45
Calcene CO	ton	105.00 /	125.00
NC	ton	80.00 /	100.00
TM	ton	82.50 /	102.50
Car-Bel-Rez C	lb.	.126 /	.1451
Clays			
A. F. D. Filler	ton	29.50 /	36.00
Aiken	ton	14.00	
Albacar	ton	50.00 /	55.00
Buca	ton	45.00	
Burgess Iceberg	ton	50.00 /	80.00
Icecap K	ton	65.00 /	90.00
Burgess Pigment #20	ton	35.00 /	60.00
#30	ton	37.00 /	60.00
Catalpo	ton	$35.00	
Champion	ton	14.50	
Crown	ton	14.00 /	$33.00
Dixie	ton	14.50 /	15.00
Franklin	ton	13.50 /	35.25
GK Soft Clay	ton	11.00	
Harwick	ton	21.50 /	77.00
Hi-White R	ton	10.00 /	14.50
Hydratex R	ton	28.00	
Kaolloid	ton	10.50	
L. G. B.	ton	13.00 /	17.50
L. G. P.	ton	15.50 /	20.00
McNamee	ton	14.50 /	15.00
RX-43	ton	33.00	
Natka 1200	ton	13.00	
Par	ton	13.00 /	13.50
Paragon	ton	10.00 /	14.50
Pigment No. 33	ton	37.00	
Polyfil C	ton	25.00	
F	ton	45.00	
X	ton	30.00	
40	ton	40.00	
70	ton	53.00	
80	ton	65.00	
Recco	ton	14.00	
Sno-Brite	ton	12.50	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	
Suprex	ton	10.00 /	14.50
Swanee	ton	12.50	
Whitetex	ton	50.00	
Windsor	ton	14.00 /	30.00
Witco No. 1	ton	14.00 /	30.00
No. 2	ton	13.50 /	30.00
Clearcarb	lb.	.1175/	.1255
Cumar Resins	lb.	.095 /	.19
Darex Resins	lb.	.42 /	.49
DC Silica	lb.	1.15 /	1.40
Diatomaceous silica	ton	32.00 /	48.00
Good-rite 2007	lb.	.36 /	.38
2057	lb.	.30 /	.31
Hi-Sil 233	lb.	.0825/	.0975
X303	lb.	.40 /	.45
Hycar 2001	lb.	.55	
2007	lb.	.39	
Indulins	lb.	.06 /	.08
Kralac A-EP	lb.	.43 /	.54
Laminar	ton	30.00	
Magnesium carbonate DCI	lb.	.11	
Marinco CL	lb.	.11 /	.14
Marbon Resins	lb.	.36 /	.43
Multifex MM	ton	117.50 /	137.50
Super	ton	167.50 /	187.50
Neville Resins			
465	lb.	.075 /	.08
LX-509	lb.	.33 /	.35
Nebony	lb.	.045 /	.05
Paradene	lb.	.07 /	.08
R	lb.	.145 /	.205
Para Resins 2457	lb.	.04 /	.045
Parapol S-Polymers	lb.	.44	
Picco Resins	lb.	.0875/	.19
Piccolyte Resins	lb.	.2225/	.2525
Piccoumaron Resins	lb.	.0875/	.19
Piccovars	lb.	.145 /	.20
Pliolite NR types	lb.	.98 /	1.33
S-3	lb.	.42 /	.49
-6	lb.	.36 /	.43
B	lb.	.36 /	.43
E	lb.	.36 /	.43
Plio-Tuf G85C	lb.	.52 /	.59
Purecal M	ton	56.75 /	71.75
SC, T	ton	110.00 /	125.00
U	ton	120.00 /	135.00
R-B-H 510	lb.	.15 /	.22
Resinex	lb.	.0375/	.0525
Rubber Resin LM-4	lb.	.28 /	.35
Silene EF	lb.	.06 /	.07
L	lb.	.0575/	.0675
Silvacons	ton	55.00 /	85.00
Transphalt	lb.	.0375/	.0575
Witcarb P	ton	117.50 /	153.50
R	ton	127.50 /	163.50
Regular	ton	60.00 /	96.00
Zeolex 23	lb.	.06 /	.07
Zinc oxide, commercial†	lb.	.145 /	.155

Retarders

Benzoic acid TBAO-2	lb.	.44	
Good-rite Vultrol	lb.	.62 /	.66
R-17 Resin	lb.	.1075/	.36
Retarder ASA	lb.	.57	
E-S-E-N	lb.	.39 /	.41
J	lb.	.68 /	.70
PD	lb.	.39 /	.41
W	lb.	.46 /	
Retardex	lb.	.47 /	.50
Thionex	lb.	1.14	
Wiltrol P	lb.	.37 /	.39

Solvents

Bondogen	lb.	.555 /	.605
Butyrolactone	lb.	.60 /	.65
Cosol #1	gal.	.37 /	.43
#2	gal.	.42 /	.48
Dichloro Pentanes	lb.	.04 /	.07
Dipentene DD, Sunny South	gal.	.42 /	.63
Ethylene dichloride, comml.	lb.	.09 /	.122
Hi-Flash 2-50-W	gal.	.41	
Pale yellow	gal.	.39	
LX-572	gal.	.27 /	.32
-748	gal.	.16 /	.23
Methyl-2-pyrrolidone	lb.	.75 /	.80
Neville Nos. 100, 104	gal.	.52 /	.60
106	gal.	.38 /	.46
Nevsolv H, 200	gal.	.19 /	.29
HF, T, 30	gal.	.24 /	.34

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Picco Hi-Solv Solvents	gal.	.16 / .48
Pine Oil DD, Sunny South	lb.	.15
Skellysolve-B	gal.	.17
-C	gal.	.162
-H	gal.	.148
-R, -V	gal.	.139
Stauffer Carbon Disulfide	lb.	.0525/ .085
Tetrachloride	lb.	.0825/ .475

Tackifiers

Actinol DLR	lb.	.0625/ .085
Bardol, 639	lb.	.0275/ .0375
Borden, Arcco		
A25, A26, 716-30	w.	.18 / .19
555-40R	lb.	.185 / .205
620-32B	lb.	.20 / .21
716-35	lb.	.17 / .18
1041-21	lb.	.165 / .175
BRH 2	lb.	.0213/ .0351
Bunarex Resins	lb.	.065 / .1225
Bunaweld 480	lb.	.24
Chlorowax 70	lb.	.18 / .24
Contogums	lb.	.0875/ .11
Cumar Resins	lb.	.095 / .19
Galex W-100	lb.	.155 / .17
W-100D	lb.	.1525/ .1625
Indopol H-35	gal.	.65 / .84
H-50	gal.	.70 / .89
-100	gal.	.85 / 1.08
-300	gal.	1.00 / 1.24
-1500	gal.	1.48
L-10	gal.	.40 / .59
-50	gal.	.45 / .64
-100	gal.	.55 / .74
Kenflex resins	lb.	.18 / .27
Koresin	lb.	.90 / 1.10
Natac	lb.	.1685/ .1785
Nevindene	lb.	.15 / .18
Picco Resins	lb.	.0875/ .19
Piccolastic Resins	lb.	.21 / .27
Piccolyte Resins	lb.	.2225/ .2525
Piccopale Resins	lb.	.089 / .13
Piccoumaron Resins	lb.	.0875/ .19
R-B-H 510	lb.	.15 / .22
Roelflex 1118A	lb.	.39
Synthetic 100	lb.	.41
Synthol	lb.	.17 / .2625
United	gal.	.69 / 1.20
Vistanex, LM grades	lb.	.45

Vulcanizing Agents

Dibenzo G-M-F	lb.	2.60
G-M-F #113, #117	lb.	.90
Di-Cup	lb.	1.10
Dodecenyl succinicanhydride	lb.	.75 / .76
HMDA-Carbamate	lb.	4.50 / 4.90
Ko-Blend I, S	lb.	.39
Litharge (*See Accelerator-Activators, Inorganic*)		
Magnesium oxide	lb.	.2525/ .38
DCI	lb.	.215 / .235
601	lb.	.2525
Maglite D, K, Y	lb.	.2525/ .305
L	lb.	.2975/ .3225
M	lb.	.27 / .32
Marmag	lb.	.2475/ .295
Michigan No. 1782	lb.	.2525/ .30
PSD 85	lb.	.37 / .50
Red Lead (*See Accelerator-Activators, Inorganic*)		
Seamag	lb.	.20 / .22
Sulfasan R	lb.	1.55
Sulfur flour, commL	100 lbs.	2.55 / 3.30
1018	lb.	.12 / .1575
Aero	100 lbs.	2.40 / 7.75
Crystex	lb.	.195 / .23
Insoluble 60	lb.	.125 / .13
Rubbermakers	100 lbs.	2.65 / 4.55
Stauffer	lb.	.0265/ .054
Telloy	lb.	4.00
VA-7	lb.	.50
Vandex	lb.	7.00
Vultac No. 2	lb.	.47 / .74
3	lb.	.51 / .78
White lead silicate (*See Accelerator-Activators, Inorganic*)		

Synthetic Rubbers

(Continued from page 126)

Synpol 8200		$0.191[b] / $0.197[b]
8201, 8208		.175[b] / .181[b]
8202		.1725[b]/ .1785[b]

Cold SBR Oil-Black Masterbatch

Ameripol 1805		.155[e] / .161[e]
4750		.1545[e]/ .1605[e]
4751		.140[e] / .146[e]
4753		.148[e] / .154[e]
4759		.16 / .166
4760		.1576[e]/ .1636[e]
4761		.171[e] / .177[e]
Baytown 1801		.176[b]
Carbomix 3751, 3758		.1545[e]/ .1605[e]
3753		.164[e] / .170[e]
3757		.148[e] / .154[e]
3760-NS		.1496[e]/ .1556[e]
Gentro-Jet 9250		.158
9251		.164
Gentro-Jet 9252		$0.167
9275		.150
OB-102		.1825[a]
-104		.1475[a]
-110		.141[a]
Philprene 1606		$0.182[b] / .188[b]
1803		.174[b] / .18
1805		.155[b] / .161[b]
1808		.148[b] / .154[b]
6604		.208[b] / .214
6608		.146[b] / .152[b]
6662		.1845[b]/ .1905[b]
S-1800		.1475[a]
-1802		.141[a]
-1803		.165[a]
-1806		.151[a]
-1807		.154[a]
-1808		.142[a]
Synpol 8253		.1584[b]/ .1644[b]
8254		.1545[b]/ .1605[b]
8255		.148[b] / .154[b]
8267		.164[b] / .17[b]

Cold SBR Rosin Masterbatch

Copo 3900		.231[e] / .237[e]

Cold SBR Latex

CL-101		.28[a]
Copo 2101		.30[c] / .4025[c]
2102, 2105, 2110		.32[c] / .3725[c]
2108		.30[c] / .3675[c]
2109		.2775[e]/ .3450[c]
3852		.30[e]
FR-S 2105		.32[e] / .366[c]
Naugatex 2105, 2107		.32[a] / .38[a]
2108		.30[a] / .38[a]
2113		.29[a] / .36[a]
Pliolite Latex 2101		.30[c]
2105, 2107		.32[c]
2108		.30[c]
Polysar Latex 721		.32[c]
S-2101		.26[a]
-2105		.28[a]
-2107		.32[a]
-2108		.29[a]

Misc. SBR

FR-S-110 (latex)		.3000[e]
-150 (latex)		.3000[e]
-174 (latex)		.2950[e]
-176 (latex)		.2775[e]
-182		.241[e] / .247[e]
-184		.1885[e]/ .1945[e]

Urethane Types

Adiprene L, LD-167,-213		1.15 / 1.65

■

Mexico's Imports

(Continued from page 125)

ysis of the figures shows that imports in 1959 exceeded those for 1958 in every month except March, May, and June, when 1958 arrivals of rubbers were unusually heavy.

The higher imports reflect the advance of the Mexican rubber goods industry, and authoritative sources estimate that final output figures for 1959 should show an increase of 8-10% over those of the preceding year. Most of the rubber goods are made by five manufacturers. Chief products are tires and tubes for automobiles (accounting for more than 70% of the total value), heels and soles, hose, besides substantial amounts of miscellaneous articles included under "other goods."

With the growth of domestic production, purchases of foreign manufacturers have naturally declined. This drop has pronounced with tires, imports of which fell from 845 tons, value 12,051,000 pesos, in 1955 to 416 tons, value 6,641,000 pesos, in 1958, a decrease of more than 50% in quantity and 45% in value.

At the same time a small export business has developed chiefly in tires and "other goods." In 1958 Mexico also exported 1,358 tons of zinc oxide, valued at 3,612,000 pesos.

index to advertisers

A

Albert, P. E., & Son 135
Allied Chemical Corp., National Aniline Division 59
American Hard Rubber Co. 137

B

Bata Shoe Co., Inc. 133
Bolling, Stewart, & Co., Inc. 55

C

Cabot, Godfrey L., Inc. .... Back Cover
Carter Bell Mfg. Co., The 20
Cary Chemicals, Inc. 23
Chemdye Rubber Corp. 48
Claremont Flock Corp. 131
CLASSIFIED ADVERTISEMENTS 133, 135, 137
Cleveland Liner & Mfg. Co., The Third Cover
Columbia-Southern Chemical Corp. Insert 14, 15
Columbian Carbon Co. 62, 63
Continental Carbon Co. 52, 53

D

Dow Corning Corp. 33
DPR Incorporated, A Subsidiary of H. V. Hardman Co. 131
du Pont de Nemours, E. I., & Co. Second Cover
Durez Plastics Division, Hooker Chemical Corp. 119

E

Eagle-Picher Co., The 44
English Mica Co., The 137
Enjay Chemical Co., A Division of Humble Oil & Refining Co. 104

F

Farrel-Birmingham Co., Inc. 21
French Oil Mill Machinery Co., The 32

G

General Tire & Rubber Co., The (Chemical Division) 34, 35
Genseke Brothers 41
Glidden Co., The ..... Insert 103
Goodrich, B. F., Chemical Co. 3
Goodrich-Gulf Chemicals, Inc. Insert 91-94
Goodyear Tire & Rubber Co., Inc., The (Chemical Division) Insert 11-12; 13

H

Hall, C. P., Co., The 51
Harwick Standard Chemical Co. ... 61
Hoggson & Pettis Mfg. Co., The ... 135
Holmes, Stanley H., Co. 44
Hooker Chemical Corp., Durez Plastics Division 119
Huber, J. M., Corp. 64
Hughson Chemical Co. 138

J

Johnson Corp., The 48

K

Ketjen Carbon, Ltd. 30, 31
K. B. C. Industries, Inc. 137

L

Litzler, C. A., Co., Inc. 10

M

Marbon Chemical Division of Borg-Warner Corp. 17
Morton Chemical Co. 29
Muehlstein, H., & Co., Inc. 25

N

National Aniline Division, Allied Chemical Corp. 59

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National Rosin Oil Products, Inc. .. 137
National-Standard Co. .... Insert 26-28
Naugatuck Chemical Division of U. S. Rubber Co. .... 113; Insert 114
Netherlands Sales Office of Chemical Products 30, 31
Neville Chemical Co. 18, 19

P

Phillips Chemical Co. 6
Polymer Corp., Ltd. .... Insert 123, 124

R

Rare Metal Products Co. 137
Richardson, Sid, Carbon Co. 140
Richardson Scale Co. 129
Roebling's, John A., Sons Division, Colorado Fuel & Iron Corp., The Insert 49
Ross, J. O., Engineering, Division of Midland-Ross Corp. 60

S

Scott Testers, Inc. 121
Shaw, Francis, & Co., Ltd. 16
Shell Chemical Co., Synthetic Rubber Division ..... Insert 37-40
Shore Instrument & Manufacturing Co., Inc., The 135
Silicones Division, Union Carbide Corp. 125
Sinclair-Collins Valve Co., The 43
Snell, Foster D., Inc. 137
South Texas Tire Test Fleet, Inc. ... 131
Spadone Machine Co., Inc. 36
Sprague Electric Co. 133
Stamford Rubber Supply Co., The .. 24

T

Taylor Instrument Cos. 58
Texas-Butadiene & Chemical Corp... 54
Texas-U.S. Chemical Co. .. Insert 56, 57
Textile Proofers, Inc. 129
Thiokol Chemical Corp. 45

U

Union Carbide Corp., Silicones Division 125
United Carbon Co., Inc. 46, 47
United Rubber Machinery Exchange 135
U. S. Rubber Reclaiming Co., Inc. .. 42
Universal Oil Products Co. 9

V

Vanderbilt, R. T., Co., Inc. 66

W

Wellington Sears Co. 127
Wiegand, W. B. 137
Witco Chemical Co., Inc. 52, 53
Wood, R. D., Co. 50

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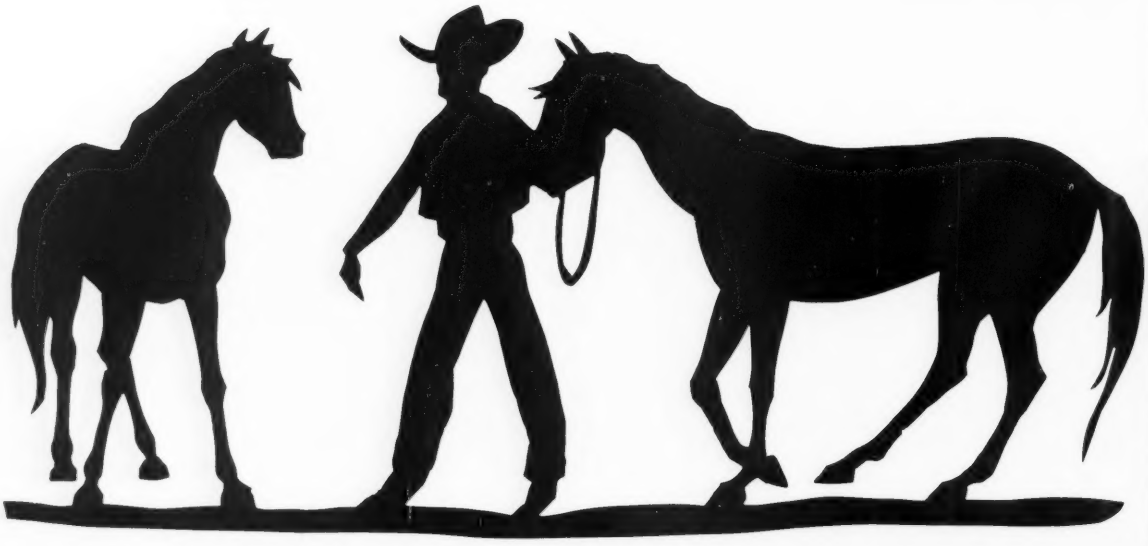

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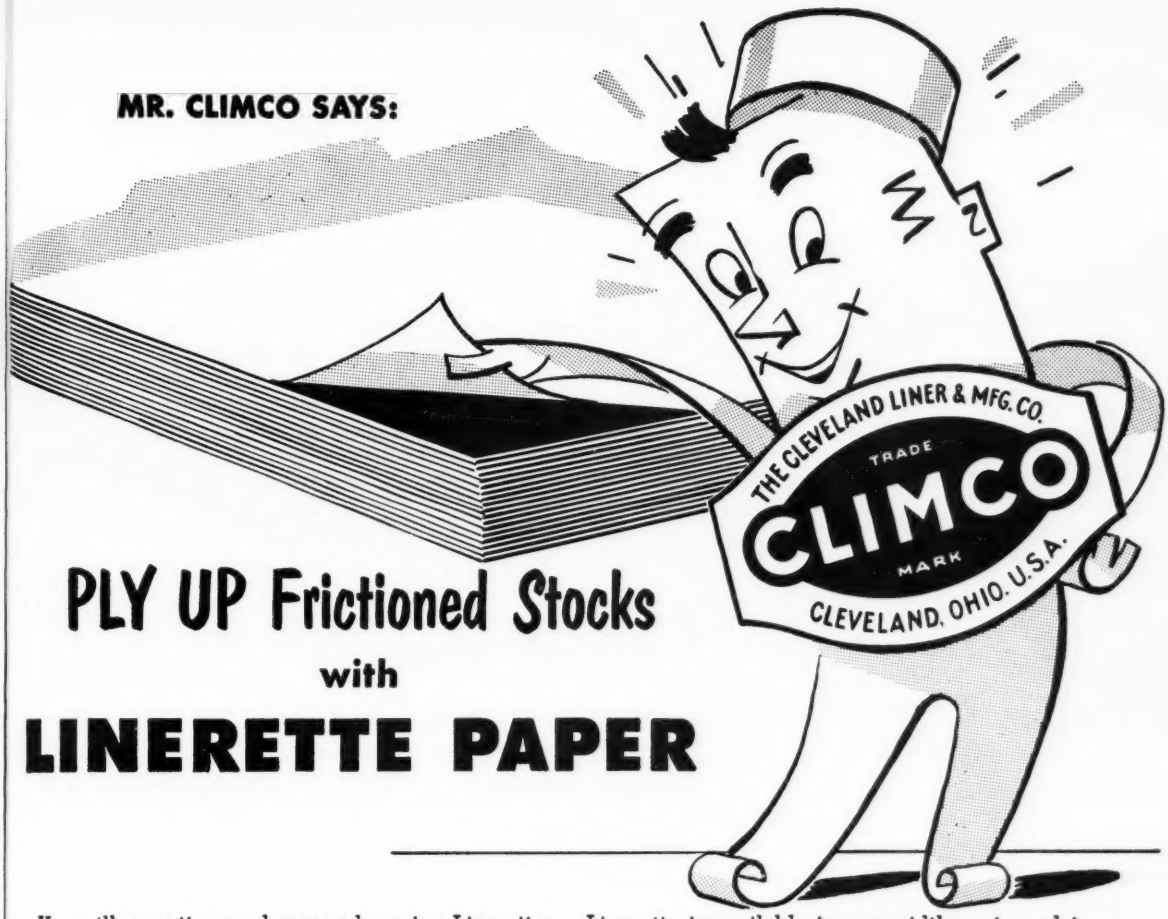

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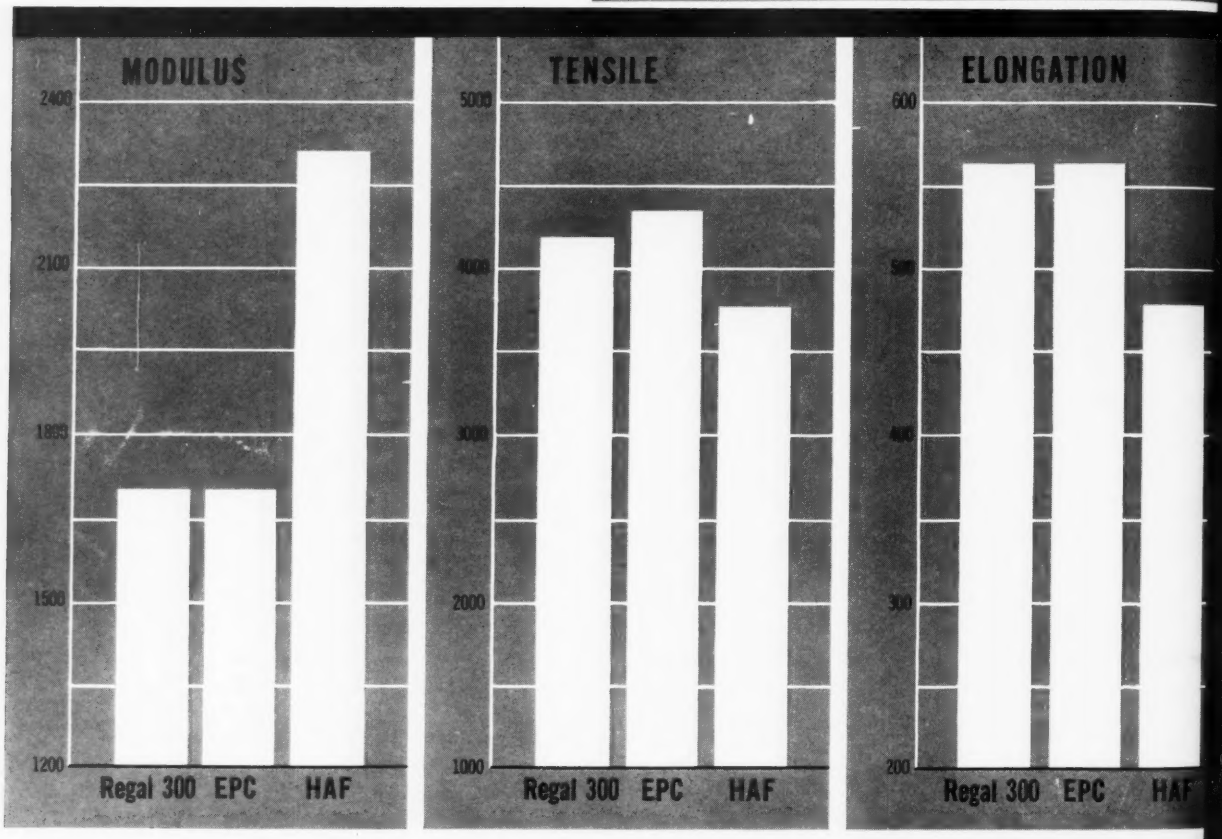

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